ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

APRIL 1956

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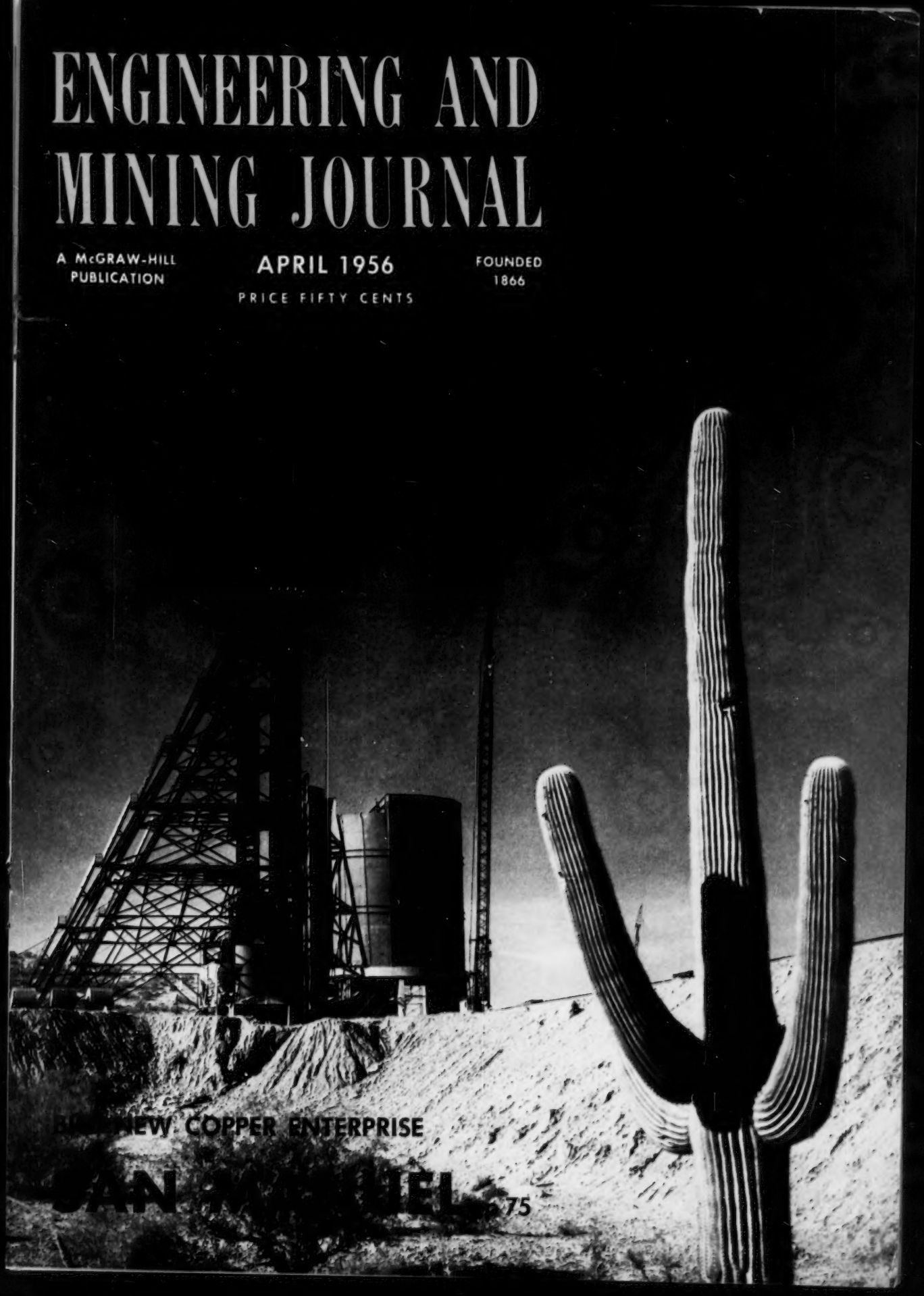

For those *nasty corrosive* slurries!

Centriseal Pumps are proving themselves to be paragons of efficiency and economy in handling abrasive pulps containing cankerous acids such as phosphoric or hydrofluosilicic. All the wearing parts are of moulded Maximix Rubber or Neoprene, both of which outlast metal many, many times ... when one does succumb to abrasion, it is easily replaced. The metal parts around the stuffing boxes are made of the necessary corrosive-resistant materials. The outstanding performance of Centriseals suggests that they will benefit you too. So, write us.

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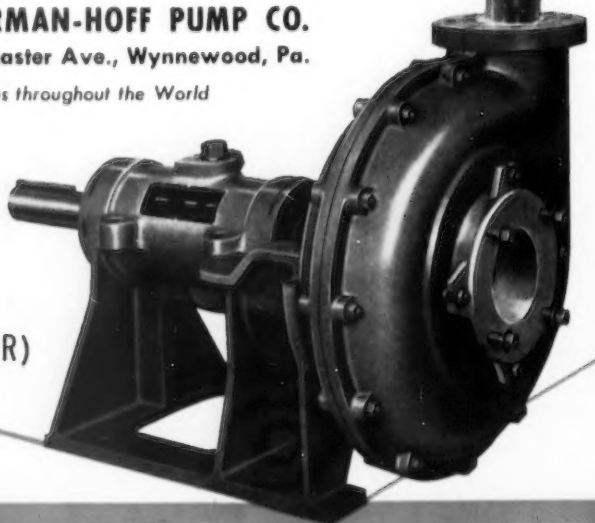

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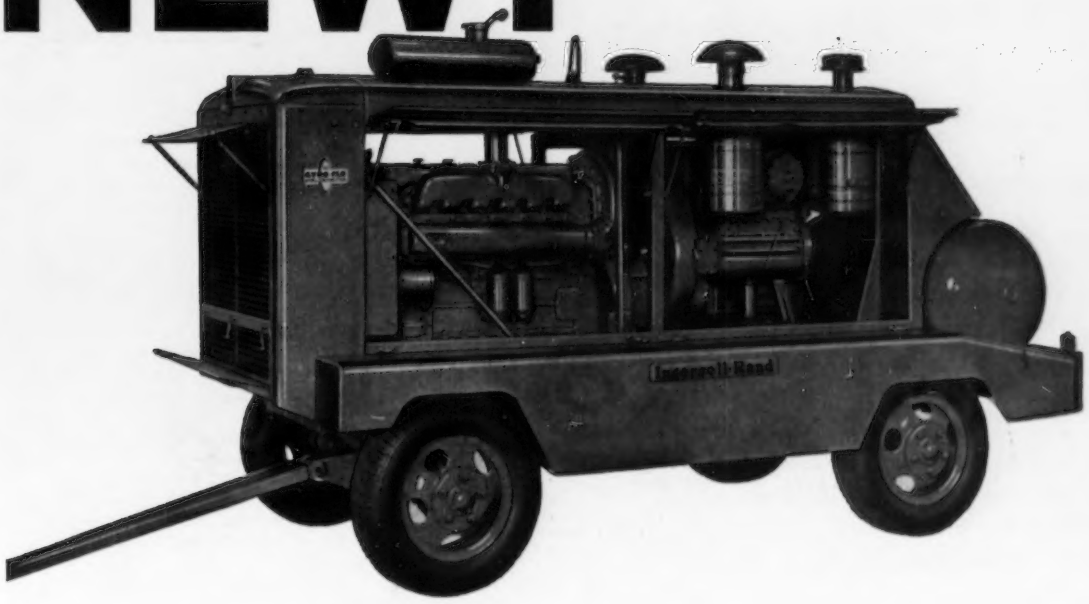
(NO SEALING WATER)

Centriseal and Hydroseal Slurry pumps are interchangeable—only the rubber impellers and engine-side shell half-liners are different. One type of pump can be transformed into the other with little more effort than it takes to change a tube in a tire.

Seven Sizes — 1½" to 14" for 400 to 8 mesh

CENTRISEAL and HYDROSEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

NEW!



a 900 cfm GYRO-FLO

HAS BEEN ADDED TO INGERSOLL-RAND'S COMPLETE LINE OF PORTABLE ROTARY COMPRESSORS

Now there are 5 sizes . . . 125, 210, 315, 600 and 900 cfm.

There's only one GYRO-FLO . . . Ingersoll-Rand's Rotary Portable Compressor . . . Introduced in 1950

IN THIS new addition to the time-tested GYRO-FLO line, Ingersoll-Rand brings you a heavy-duty compressor that delivers a full 900 cfm at 100 psi — yet weighs only 14,340 pounds ready-to-go, and is but slightly larger than the famous GYRO-FLO 600.

The smooth, dependable and virtually maintenance-free performance of the GYRO-FLO rotary compressor is a matter of record on drilling and construction projects the world over. When you have a job calling for 900 cfm of air power, ask your Ingersoll-Rand representative to tell you more about this new, heavy-duty GYRO-FLO 900.

Ingersoll-Rand

2-357 11 Broadway, New York 4, N. Y.

AN UNBEATABLE COMBINATION . . . GYRO-FLO COMPRESSORS AND I-R ROCK DRILLS

ENGINEERING AND MINING JOURNAL

90th YEAR OF PUBLICATION

VOL. 157 NO. 4

APRIL 1956

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LETTERS

Mining in the Early 1800s

For the past year I have heard the repeated remark by some of the Salmon (Lemhi County, Idaho) business men, and then echoed by the Idaho sportsmen. "A thorium and uranium rush would bring the trash to Lemhi." Most of these same men were once (I can remember) or their dads were, mining "trash" themselves.

I don't like this word "trash," for I have been one to go into some of the rush areas myself. And it brings to mind a verse written away back in the early 1800s, taken from the scrapbook of a Leesburg placer miner's wife, Mrs. Richardson, my grandmother. Written by Berton Braley, it's called "Driftwood."

Call me a miner er call me a tramp.
I've been a little of each,
I've floated in many a camp,
An' drifted upon the beach.
I've drifted from Salt Lake to Jerome,
The Comstock has knowed me, too.
Wherever I am I calls my home,
An' my trade's whatever I do!

Driftin' along, driftin' along,
Floatin' wherever the tide is strong.
Goin' no place an' everywhere,
No one to know an' no one to care,
Gettin' in right er gettin' in wrong—
Driftin', driftin' along.

I'm a Native Son er a peerless Plug,
I'm a Notcher, I guess, as well,
An' down in Nevader I have dug,
In heat, hot water an' hell.
High-graded a bit down Goldfield way,
Gumbooted a bit in Nome,
My habitat is where I stay,
An' wherever I am is home.

Driftin' along, driftin' along,
What do I care if you think it's wrong?
I gets my clothes an' a drink or two,
An' the rest of my life is nuthin' to you.
Floatin' wherever the tide is strong—
Driftin', driftin' along.

Maybe I works a month er so,
Maybe I works a shift,
An' when I'm ready an' primed to go,
I quit my workin' to drift.
Sometimes I drifts to the county jail,
An' ceases, sudden, to roam,
Fer I has no cash an' I gets no bail,
So wherever I am is home!

Driftin' along, driftin' along,
That's the melody of my song.
When I dies I reckon I'll drift
To a hot-box hole an' an endless shift,
But still I'll go where the tide is strong—
Driftin', driftin' along.

G. Elmo Shoup
Salmon, Idaho

Setting the Record Straight

May I offer a comment on the statement on page 172 of the February issue of *E&MJ*, that the Pacific Coast Borax

(Continued on page 108)

B.F.Goodrich

They'll make shiny new cars out of that "red dirt"

A typical example of B. F. Goodrich improvement in rubber

THAT stream of "red dirt" is iron ore. Giant-size machines, each taking 17-ton bites at a time, unload the ship. But the chunks of ore hit the conveyor belts on the unloader with such force that belts used to last only a season or two. Sometimes there were lumps weighing half a ton or more. The rubber would be cut and the fabric weakened.

Then engineers decided to try B. F. Goodrich cord belts, designed to take smashing blows. Some of them have lasted three years, some four years—three or four times as long as former belts. The belt in the picture is the newest of all. Engineers specified a B. F. Goodrich cord belt after this experience. It will carry millions of tons, from which will come steel for shiny new cars and thousands of other things.

B. F. Goodrich conveyor belts invariably save money for users because they're engineered for the special jobs to be done. Some kinds of belts stand hot materials, lasting far longer than others ever used to last. Some stand temperatures below zero. Some are made to handle wet, sticky or freezing materials without clogging pulleys. Some types are made especially for food products. Some are made to carry packages and other things up very steep inclines without letting them slide down. In fact, there's a B. F. Goodrich belt for almost every problem. Belts are made of many kinds of cords and fabrics, many different kinds of rubber compounds.

Call your B. F. Goodrich distributor for more information about any kind of belting, hose or other B. F. Goodrich rubber products. *The B. F. Goodrich Co., Dept. M-600, Akron 18, Ohio.*

B.F.Goodrich

INDUSTRIAL PRODUCTS DIVISION

Crater's 3-way protection keeps rope strong longer

TEXACO CRATER is the penetrating lubricant that protects wire rope three ways: (1) it adheres tenaciously to the strands, providing a tough, wear-resisting lubricating film; (2) it forms an effective barrier against rust; and (3) it surrounds and preserves the core.

Texaco Crater is easy to apply, will not harden and chip off in cold weather, gives long-lasting protection that keeps rope strong longer.

Texaco Crater is also ideal for open gears. It clings to the gear teeth, assuring long-lasting protection, smoother, quieter operation and longer gear life.

For convenient fluid application, use *Texaco Crater X Fluid*. It *goes* on as a liquid, *stays* on just like the regular Crater.

For mine car wheels, use *Texaco Olympian Grease*. It stays in the bearings, assures easier starts even in winter weather.

Let Texaco Lubrication Engineering Service help you get the most efficient operation from all your equipment. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

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TEXACO STAR THEATER
starring
JIMMY DURANTE
on TV Saturday nights.
METROPOLITAN OPERA
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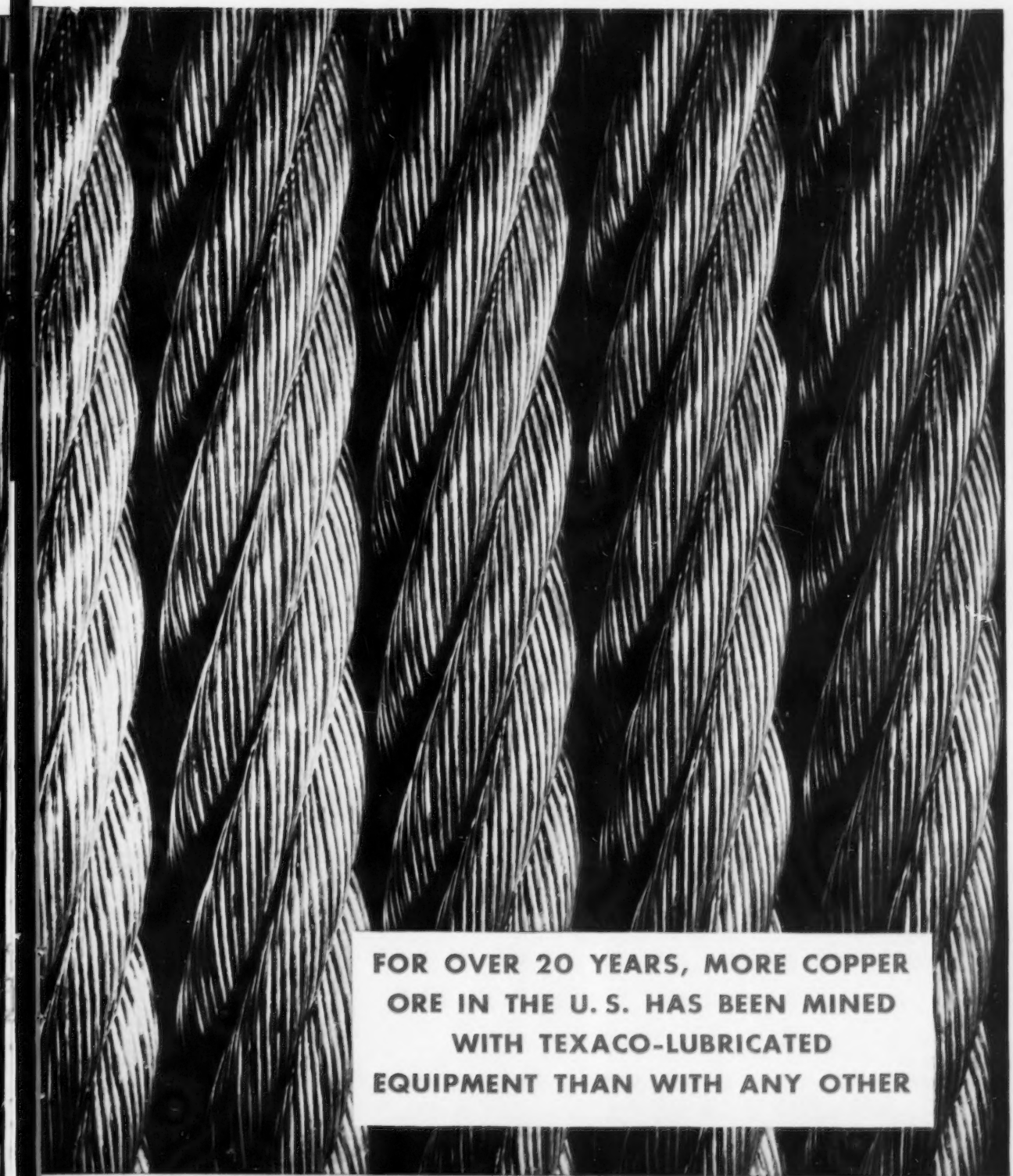
Saturday afternoons.

TEXACO

TEXACO



Lubricants and Fuels

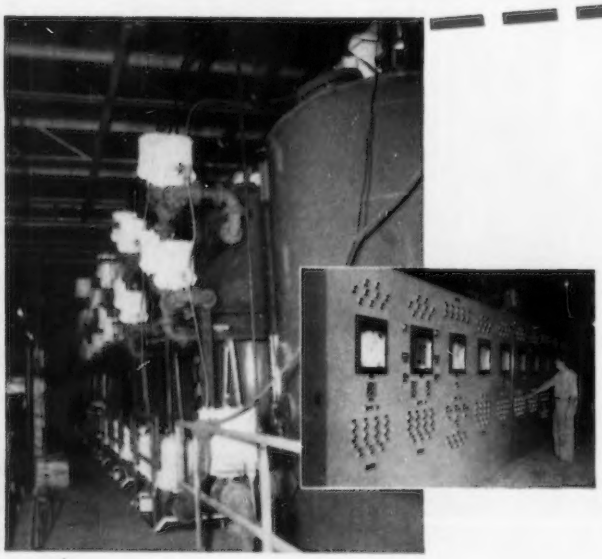
FOR THE MINING INDUSTRY

Dorr-Oliver Techniques AT PRONTO URANIUM

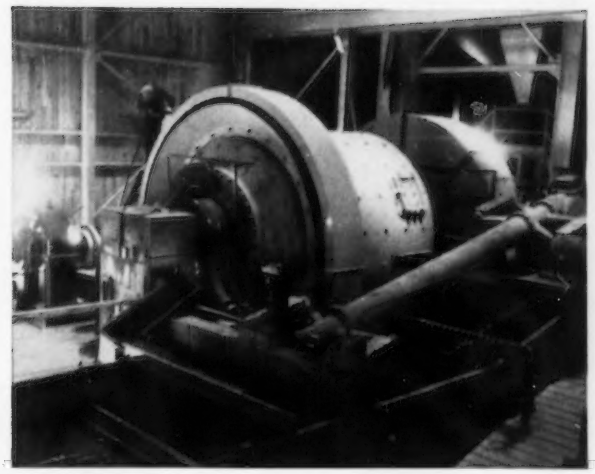
One of the first Canadian Mills to go into production utilizing ion exchange, Pronto Uranium has made skillful use of Dorr-Oliver techniques in almost every processing step in the plant. The photographs on these pages are arranged in flowsheet order to show the major treatment steps from primary grinding to final thickening ahead of dewatering.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U.S.A.

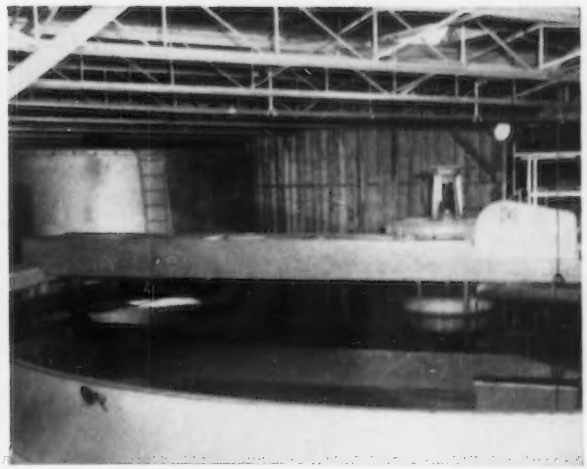
3 AGITATION — Eight 24′ dia. Dorr Agitators are used for acid leaching the uranium at 60% solids from the Thickener underflows. Three additional Agitators are used for pH adjustment of the leach slurry.



4 ION EXCHANGE — A Dorrco d-i System consisting of eight cells each 8′ dia. by 15′ deep with air domes receives the clarified pregnant solution. Inset shows ion exchange control panel.



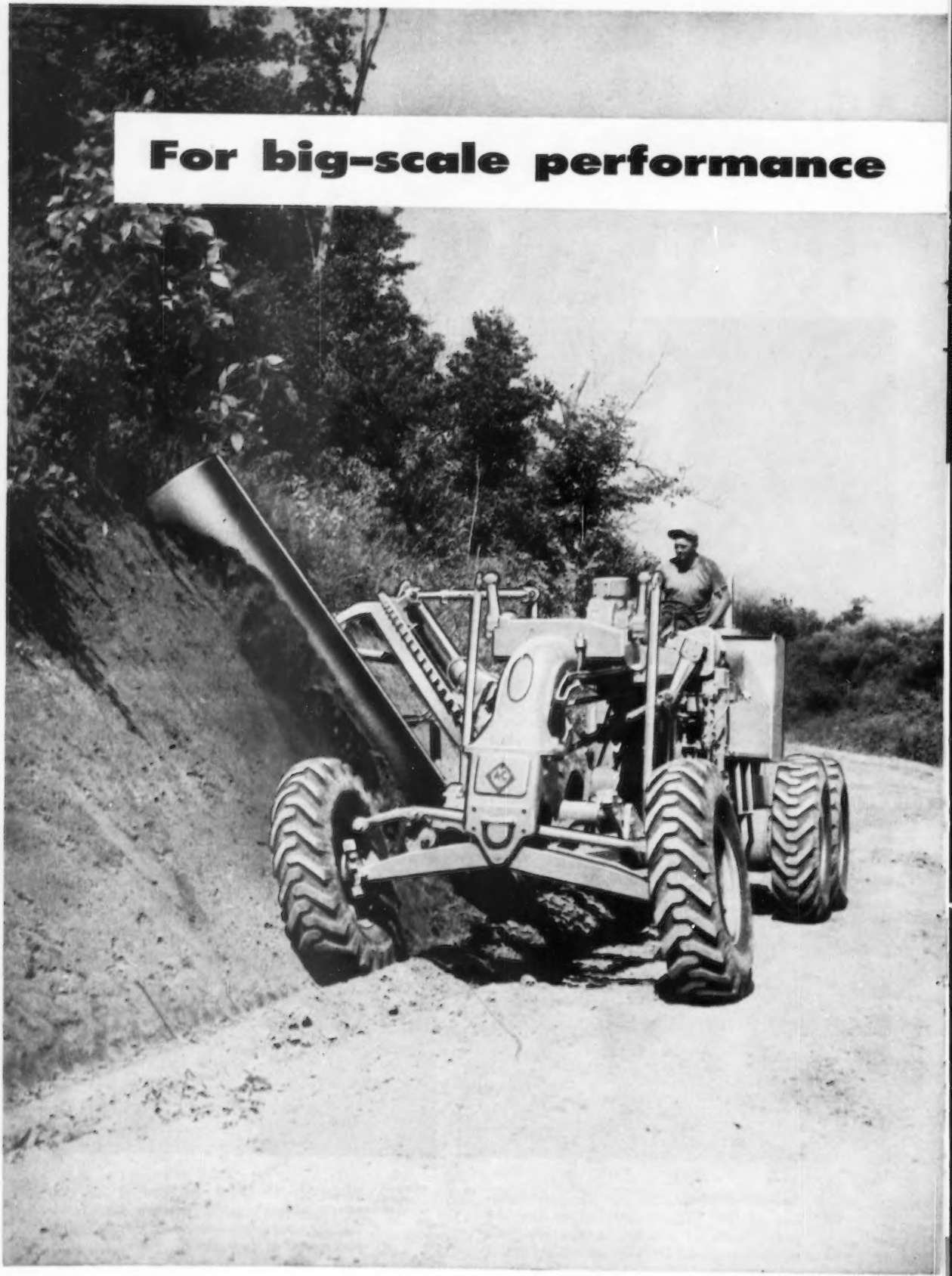
1 GRINDING — One of two Dorr HX Classifiers installed in closed circuit. Each unit has a design overflow of 900 tons per day at 65% — 200 mesh.



2 THICKENING — Classifier overflows are thickened in two 40′ dia. Dorr Tray Thickeners (one shown) and the underflows at 65% solids are removed by Dorrco VM Pumps.

5 AGITATION — Six 18′ dia. Dorr Agitators provide sufficient detention for complete precipitation of uranium concentrate from solutions received from Dorrco d-i System.

6 THICKENING — This special 32′ dia. Dorr Thickener equipped with a deep feed-well thickens precipitated slurry from Agitators ahead of dewatering.


For big-scale performance

on all grading jobs

SEE THE Forty Five BEFORE YOU BUY

Here's motor grader design that pays off in extra output on today's tougher, more precise jobs. You get these big advantages when you put the FORTY FIVE to work for you—more power at the wheels, more dirt at the blade, plus precision control and ease of operation.

Allis-Chalmers diesel engine with follow-through combustion provides real lugging ability . . . responds quickly to varying load conditions . . . has the power with tandem drive to pull through soft spots, roll big windrows, peel off that last inch of tough, hard dirt.

ROLL-AWAY moldboard reduces friction drag by rolling the load up and ahead of the blade edge . . . moves more dirt with less effort . . . makes more efficient use of engine power on sloping, rough grading, stripping and other heavy-duty construction and maintenance jobs.

Toggle-type controls give the operator fingertip command of every blade position, every job. Exclusive mechanical toggle-type action provides a positive "feel," yet operation of moldboard components, scarifier and front wheel lean is accurate and easy.

Get a demonstration of the FORTY FIVE from your Allis Chalmers dealer . . . let him show you how fully-enclosed power steering, accelerator-decelerator pedal, "box seat" comfort and visibility, and other features give you an extra measure of performance on all your grading jobs. And check the complete service program he offers you . . . factory-trained servicemen and True Original Parts for high-quality service, continued top performance and long equipment life.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION
MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

ROLL-AWAY is an ALLIS-CHALMERS trademark

Forty Five

120 brake hp

23,800 lb

6 forward speeds to 20.6 mph

3 reverse speeds to 7.0 mph

CF&I ROCK BOLTS

cut temporary drift support costs one-third

Climax Molybdenum Company is using CF&I Rock Bolts and Realock® Chain-Link Fabric to save 30-35% on temporary slusher drift support. Developed by the Climax Planning and Mining Departments, the new method:

- Enables miners driving drifts to do their own rock bolting *with the same machines used to drive heading.*
- Is much faster and more versatile than older methods.
- Has been fully tested for safety.
- Affords proved savings over old methods (35% less than 8″ x 8″ square sets; 30% less than wedge-type bolts and landing mats).

The CF&I Rock Bolts used by Climax are 7 ft. long ¾ inch diameter bolts with Pattin Expansion Shells. They have left-hand threads to allow tightening by the left-hand rotation of the drilling machines. A special adapter consisting of a machine chuck and square socket welded together is the only special accessory needed for this operation.

This is just one of the many jobs being performed by CF&I Rock Bolts—known throughout the mining industry for their dependable performance. Why not get the full details on how you can use CF&I Rock Bolts to advantage in your own mining operations? Just write the nearest sales office listed below.

EXPANSION SHELL TYPE ROCK BOLT WITH PATTIN SHELL

Here CF&I Rock Bolts and Realock Chain-Link Fabric are being installed for temporary drift support.

CF&I

Other CF&I Steel Products for the Mining Industry

Cal-Wic Industrial Screens • Wickwire Rope • Grinding Rods • Grinding Balls
Light Rails and Accessories • Realock Chain-Link Fabric

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3631

Uranium miner, James T. Gray looks over his Le Roi Model 210 Airmaster compressor, which cost him only 40¢ for repairs last year.

View of James T. Gray's uranium mine located far back on Colorado Plateau. Le Roi Model 210 Airmaster compressor, shown in background, provides air power for operation.

How 55% of Uranium Miners On Colorado Plateau Cut Air-Power Costs

One miner spent only 40¢ on compressor repairs in year.

Use of LPG fuel means additional savings in time and money.

Latest reports show that 55% of the compressors sold on the Colorado Plateau are Le Roi — the dependable air compressor. Le Roi-Cleveland air legs and rock drills were also selected to help keep costs down on most of these uranium projects.

Take the case of miner James T. Gray, for instance. Even though he's a long way back in the mountains, far from repair parts, downtime and distance don't worry him. One reason is that last year he spent only 40 cents for repairs on his major source of power—a Le Roi Model 210 Airmaster Compressor.

Six cents a gallon fuel savings provide another cost-cutting factor at Jim Gray's uranium mine. This large saving is possible because he runs the Le Roi compressor on liquid propane gas. In a year, the six-cents-per-gallon saving grows into a respectable total.

Dependable fuel supply and bulk purchases give miner Gray further dollar savings. To eliminate dangers of being cut off from fuel supply, he installed an LPG storage tank and hooked it directly to the air compressor. Once a month he fills the storage tank with LPG fuel. From this supply, he gets a steady, reliable flow of fuel for at least 30 days — an important advantage on mining projects far back on the craggy, Colorado Plateau. It's time saving, too, because it eliminates the need for daily refueling of the compressor tank.

Both the engine and compressor in the Model 210 Airmaster are manufactured by Le Roi. This assures you complete dependability and more economy. Le Roi Airmaster Compressors also have removable, copper-finned, individual radiator and intercooler core sections, for efficient cooling under all operating conditions. 100% interchangeable valves are readily accessible for quick, easy maintenance.

Le Roi Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin also manufactures Tractair and stationary air compressors, air tools, and engines. Write today for information about any of these products.

C-168

F-100 8-ft. Pickup—GVW 5,000 lbs.

T-800—GVW 42,000 lbs.; GCW 65,000 lbs.

FORD BIG JOBS can mean

FORD EXPERIENCE IN HEAVY DUTY ENGINES PAYS OFF . . .

- **Much longer peak engine performance!**
- **Much less DOWN TIME on the job!**

Ford Trucks for '56 save you money right from the start. And, they keep on saving with their extra-sturdy, long-life engine design.

For instance . . . Ford Engineers have now introduced into all heavy-duty engines the greatest valve advancements ever. As an example, see the exhaust valve in diagram on right page. The valve stem is hollow and partially filled with powdered sodium. When the sodium gets hot, it *turns into a liquid.* As it moves up and down, it carries heat away from valve head—*allows it to operate up to 225° cooler!* Result: a cleaner-running, more burn-free, longer-lived valve face.

Ford's long-lasting engine design pays off for you in every way. You save money on parts replacements such as piston rings and bearings. You save on shop labor—extend time between preventive maintenance jobs like valve adjustments, valve grindings, compression tests, ring jobs and the like.

And you can save on driver costs if you can keep trucks out of the shop and on the road. Yes, you save in every way when you get more work done per truck!

There's a Ford Truck for every trucking job. Before you buy your next truck, Test Drive a Ford Economy Truck.

FORD TRUCKS LAST LONGER

Certified by independent insurance actuaries for the ninth consecutive year! Studies of over 10,068,600 current license registrations show that Ford Trucks last up to 9.9% longer than any of the other 4 leading truck makes!

F-900—GVW 29,000 lbs.; GCW 60,000 lbs.

BIG SAVINGS in your business

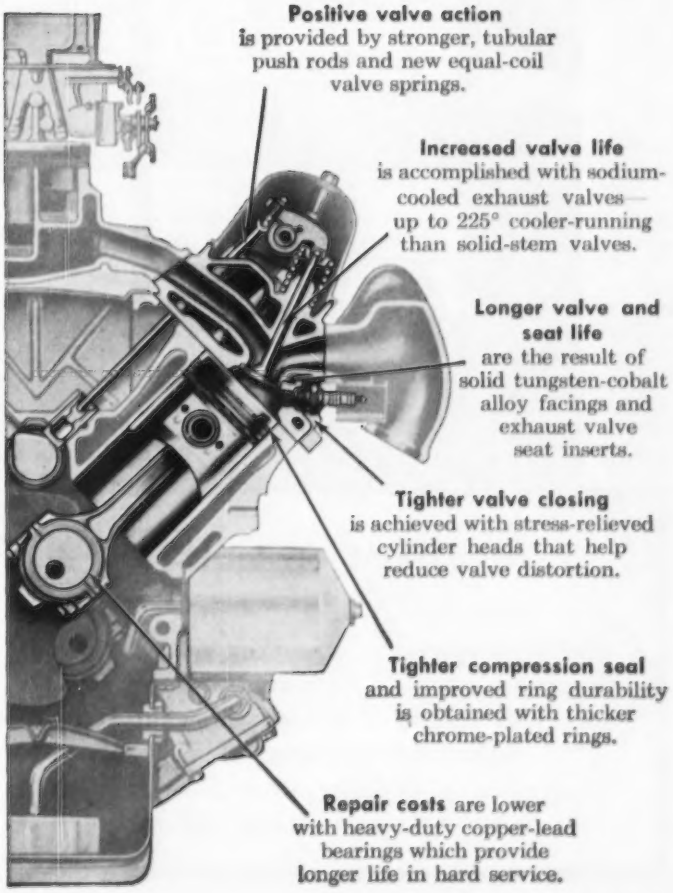
Hauls up to 3000 lbs. more than other 6-wheelers—New Ford T-800

● New power and hauling capacity of the Ford Tandem BIG JOB cuts hauling time on every run—makes giant cargos seem lightweight. You have a choice of two gas-saving Short Stroke engines. Either the 190-h.p. *Torque King* V-8 or, the 200-h.p. *Torque King* Special V-8.

You have new engine advancements for longer life (some explained and illustrated at the right).

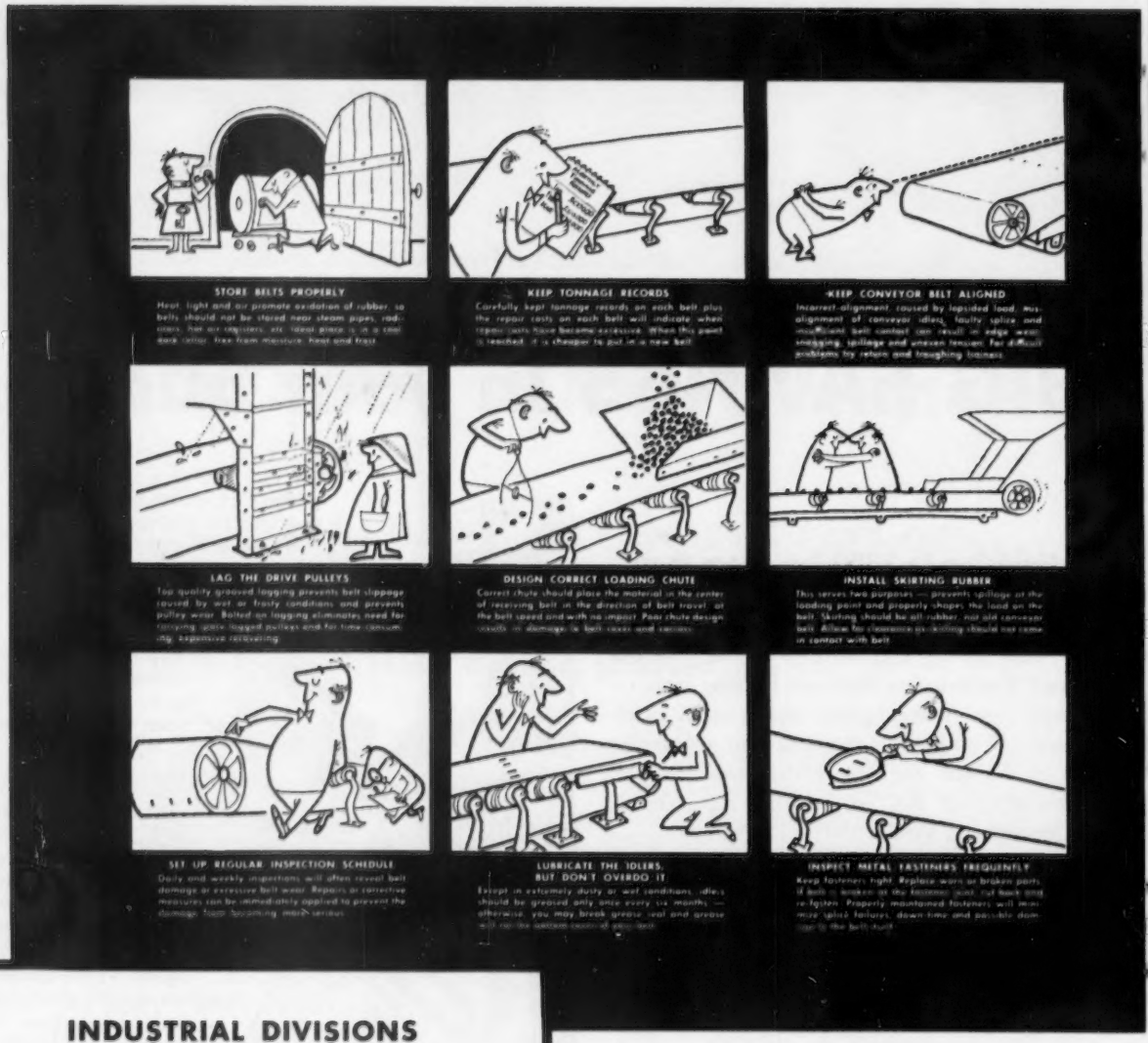
New high-capacity tubeless tires, heavy-duty 5-speed transmission and Power Steering are standard equipment, at no extra cost. Two 3-speed auxiliary transmissions and full-air brakes are available at low extra cost.

New *Driverized* Cabs for driving comfort and convenience have *Lifeguard* Design safety features found in no other truck. Lifeguard steering wheel helps protect driver from steering column; Lifeguard door latches help keep doors from jarring open in case of accident.


Positive valve action is provided by stronger, tubular push rods and new equal-coil valve springs.
Increased valve life is accomplished with sodium-cooled exhaust valves—up to 225° cooler-running than solid-stem valves.
Longer valve and seat life are the result of solid tungsten-cobalt alloy facings and exhaust valve seat inserts.
Tighter valve closing is achieved with stress-relieved cylinder heads that help reduce valve distortion.
Tighter compression seal and improved ring durability is obtained with thicker chrome-plated rings.
Repair costs are lower with heavy-duty copper-lead bearings which provide longer life in hard service.

MORE CARRY IN YOUR

Free Wall Chart gives


STORE BELTS PROPERLY
Heat, light and air promote oxidation of rubber, so belts should not be stored near steam pipes, radiators, hot air registers, etc. Ideal place is in a cool dark cellar, free from moisture, heat and frost.
KEEP TONNAGE RECORDS
Carefully kept tonnage records on each belt plus the repair costs on each belt will indicate when repair costs have become excessive. When this point is reached, it is cheaper to put in a new belt.
KEEP CONVEYOR BELT ALIGNED
Incorrect alignment, caused by lopsided load, misalignment of conveyor idlers, faulty splice, and insufficient belt contact can result in edge wear, snagging, spillage and uneven tension. For difficult problems try return and troughing balances.
LAG THE DRIVE PULLEYS
Too quickly grooved lagging prevents belt slippage caused by wet or frosty conditions and prevents pulley wear. Bolted-on lagging eliminates need for removing plain lagged pulleys and for time consuming, expensive relagging.
DESIGN CORRECT LOADING CHUTE
Correct chute should place the material in the center of receiving belt in the direction of belt travel, at the belt speed and with no impact. Poor chute design results in damage to belt cover and carcass.
INSTALL SKIRTING RUBBER
This serves two purposes — prevents spillage at the loading point and properly shapes the load on the belt. Skirting should be all rubber, not old conveyor belt. Allow for clearance so skirting should not come in contact with belt.
SET UP REGULAR INSPECTION SCHEDULE
Daily and weekly inspections will often reveal belt damage or excessive belt wear. Repairs or corrective measures can be immediately applied to prevent the damage from becoming more serious.
LUBRICATE THE IDLERS, BUT DON'T OVERDO IT
Except in extremely dusty or wet conditions, idlers should be greased only once every six months — otherwise, you may break grease seal and grease will run the bottom course of pan belt.
INSPECT METAL FASTENERS FREQUENTLY
Keep fasteners tight. Replace worn or broken parts. If belt is broken at the fastener joint, cut back and re-fasten. Properly maintained fasteners will minimize splice failures, down time and possible damage to the belt itself.

INDUSTRIAL DIVISIONS
PRODUCTS

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VIBRATING SCREENS · DESIGN, MANUFACTURE,
ENGINEERING AND ERECTION OF
COMPLETE BULK MATERIALS HANDLING SYSTEMS
"GLIDE RIDE" THE NEW MOVING SIDEWALK

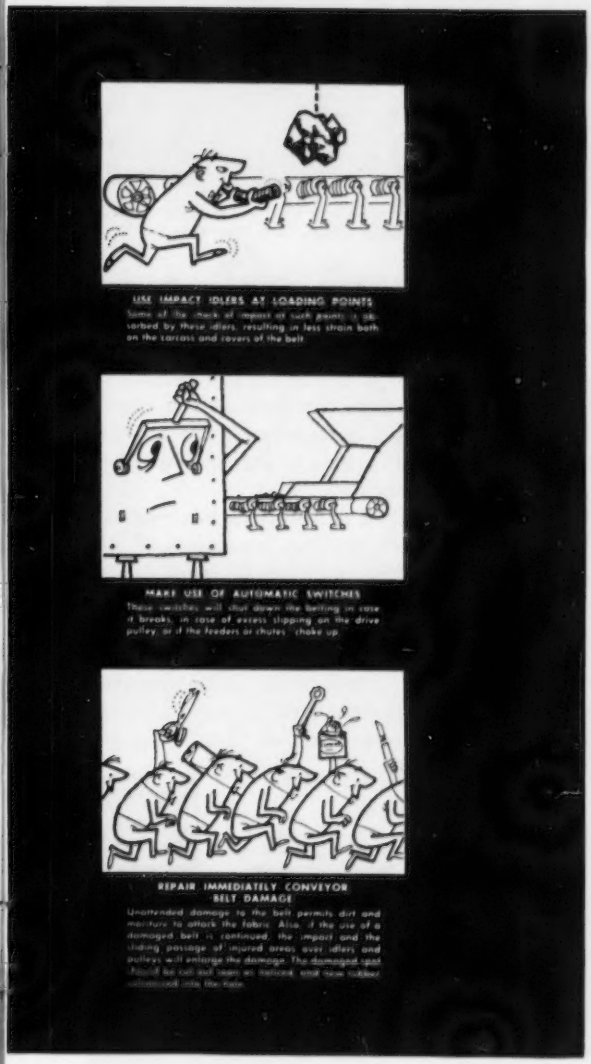
This wall chart, 23" x 33" in two colors, has many valuable tips that will enable you to increase the life of your conveyor belting. To obtain a copy, contact

HEWITT

INCORPORATED · EXECUTIVE

CONVEYOR BELTING

the answers


USE IMPACT IDLERS AT LOADING POINTS
Some of the shock of impact at such points is absorbed by these idlers, resulting in less strain both on the carcass and covers of the belt.
MAKE USE OF AUTOMATIC SWITCHES
These switches will shut down the belting in case it breaks, in case of excess slipping on the drive pulley, or if the feeders or chutes choke up.
REPAIR IMMEDIATELY CONVEYOR BELT DAMAGE
Unattended damage to the belt permits dirt and moisture to attack the fabric. Also, if the use of a damaged belt is continued, the impact and the chafing passage of injured areas over idlers and pulleys will enlarge the damage. The damaged spot should be cut out (even an inch-and) and new rubber vulcanized into the hole.

Which is the best belt for you?

For Mining *(Metallic and Nonmetallic)*

Maltese Cross for especially severe service. Ajax for general heavy duty service, and Conservo for general light duty service. Exceptionally severe special conditions may require use of specially designed Hewitt-Robins belts such as Shock Pad, CR-50 and CR-70, Raynile and Super-Raynile, Ajax Underground and Monarch Neoprene fire-resistant belting.

For Metal Processing

Maltese Cross for exceptionally severe service. Ajax for general heavy duty service, and Monarch Neoprene for oily service. Maltese Cross Fiberglas Hot Material, Maltese Cross Fabric-type Hot Material and Hewitt Hot Service are especially designed for hot material handling.

For Public Utilities

Monarch Neoprene for oily service, Maltese Cross Hot Material and Hewitt Hot Service for hot material handling. Maltese Cross for especially severe service and Ajax for general heavy duty service.

For Food Processing

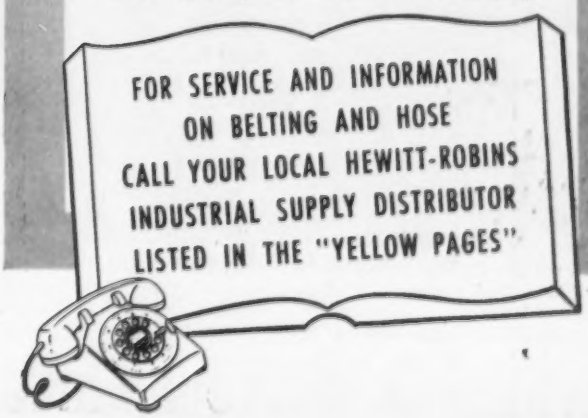
Canners and Packers and Hewlite for food handling, Monarch Neoprene for oily service, Ajax Rufftop, Conservo Rufftop and Conservo Transport for package handling. Monarch, Ajax and Conservo for grain and feed handling.

For Materials Handling

Conservo for portable conveyors. Ajax Rufftop, Conservo Rufftop, Conservo Transport and Hewlite for packaging conveyors.

For Chemical Processing *(Including Pulp and Paper)*

Maltese Cross for exceptionally severe service, Ajax for general heavy duty service, and Conservo for general light duty. Maltese Cross Fiberglas Hot Material, Maltese Cross Fabric-type Hot Material and Hewitt Hot Service are especially designed for hot material handling.


FOR SERVICE AND INFORMATION
ON BELTING AND HOSE
CALL YOUR LOCAL HEWITT-ROBINS
INDUSTRIAL SUPPLY DISTRIBUTOR
LISTED IN THE "YELLOW PAGES"

your local HR Industrial Supply Distributor or write to our executive offices in Stamford, Connecticut.

ROBINS

OFFICES: STAMFORD, CONN.

8,500-FT MINE TUNNEL IN IDAHO. Bethlehem Hollow provided standout performance during construction of a 10 ft x 11 ft bore, for which 33,000 cu yd of quartzite were removed, in lead-and-zinc mine at Burke, Idaho. Drifters are shown making 10-ft blast holes.

Rock-Removal Projects Across the Nation

TAILRACE FOR NEW DAM IN NORTH CAROLINA. About 1,000,000 cu yd of solid granite were blasted to make way for 8,000-ft tailrace, 80-ft wide, at Roanoke Rapids Dam, part of a huge hydroelectric project at Roanoke Rapids, N. C. Bethlehem Hollow, fitted with carbide-insert bits, was used in this rail-mounted drill carriage.

Shown here are several typical rock-removal projects, in widely separated sections of the country. They were selected at random from among hundreds of recent applications of that old reliable, Bethlehem Hollow Drill Steel.

Bethlehem Hollow Drill can always be counted upon for economical rock drilling, regardless of the nature of the application or depth of blast holes, because it is rolled from a tough, fatigue-resisting steel—steel that can take it.

We carry Bethlehem Hollow in stock in our mill depot in all commonly used sizes. You can also obtain it from your local converter. Give Bethlehem Hollow a workout on your next job. You'll like it!

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

WATER-INTAKE TUNNEL BENEATH NIAGARA RIVER. Bethlehem Hollow Drill provided good service as contractor removed 9,200 cu yd of rock, most of it limestone, for 6,000-ft water-intake tunnel for Town of Tonawanda, N. Y. The new tunnel is about 100 ft beneath the Niagara River.

HIGHWAY RELOCATION IN ALABAMA. This battery of wagon drills, using 1-in. hexagon Bethlehem Hollow, fitted with carbide-insert bits, is shown biting into medium-hard limestone on Sand Mountain, near Gadsden, Ala. This highway contract called for the removal of about 150,000 cu yd of rock.

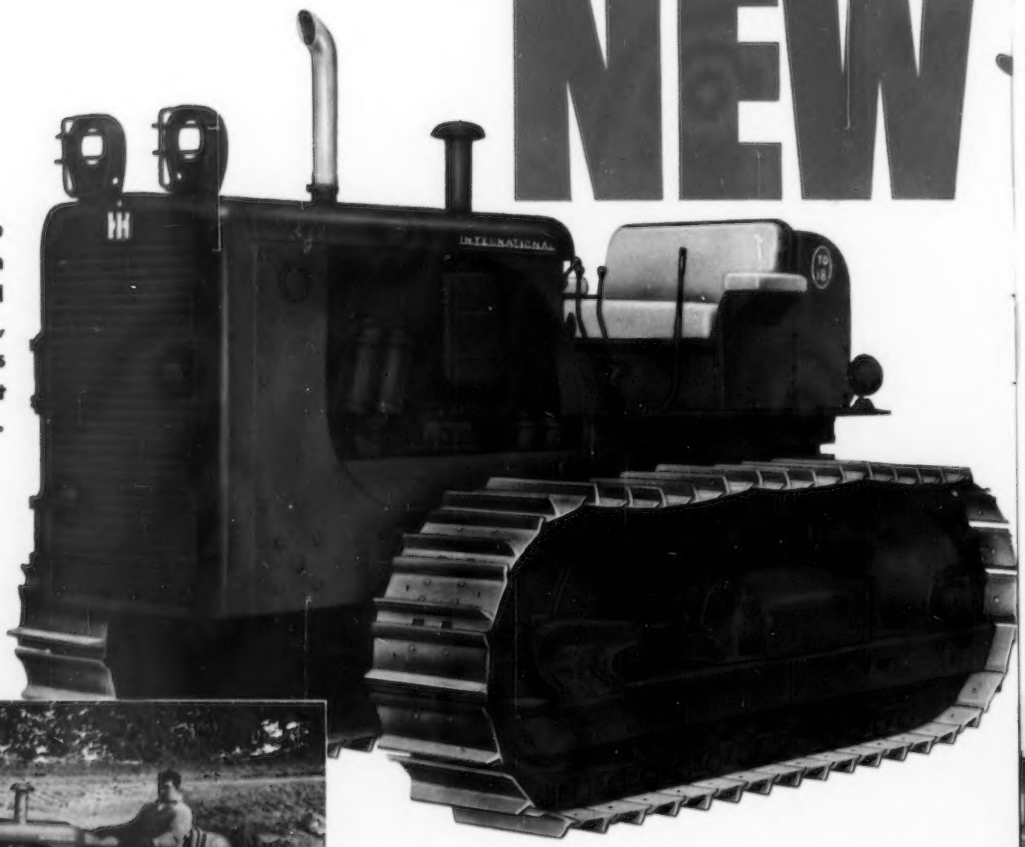
BETHLEHEM HOLLOW DRILL STEEL • CARBON AND ULTRA-ALLOY •

NEW...

Bonus Powered too!

NEW

124 Net Engine Horsepower. In International Drott Machines, Engine develops 134 Net Horsepower.



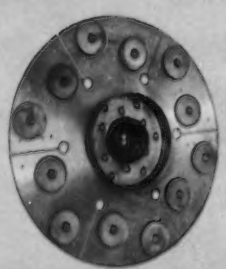
182 Series

TD 18

TD-18 diesel (series 182) delivers 103 drawbar horsepower, with weight of 29,050 pounds (without equipment). All-weather electric starting, standard equipment. "New look" visibility, operating ease never before available. New heavy-duty, swinging-door type radiator guard is "standard"—for carrying heavy front-mounted equipment. Gives big tractor performance in pioneering under roughest conditions. Powers 3-yard International Drott Skid-Shovel, anywhere.

No costly delay from a "killed" or cold engine—you start fast! Famous international *gasoline-conversion* diesel starting—*actual* "in-seat" starting—is *standard equipment* on this new crawler line. With "push-button" ease, you get seconds-fast starting, whether the engine is cold, or stopped! And you're on the job seconds-fast, when minutes are dollars.

Cerametallic Engine Clutch Facings Save power, defy heat, prolong life! Uncomplicated, *familiar-to-all* engine clutch design of these new crawlers have *power-holding, heat-defying, long-lasting* Cerametallic facings. These facings reduce lever-pull up to 50%, provide amazing heat immunity, add service freedom, cut upkeep!



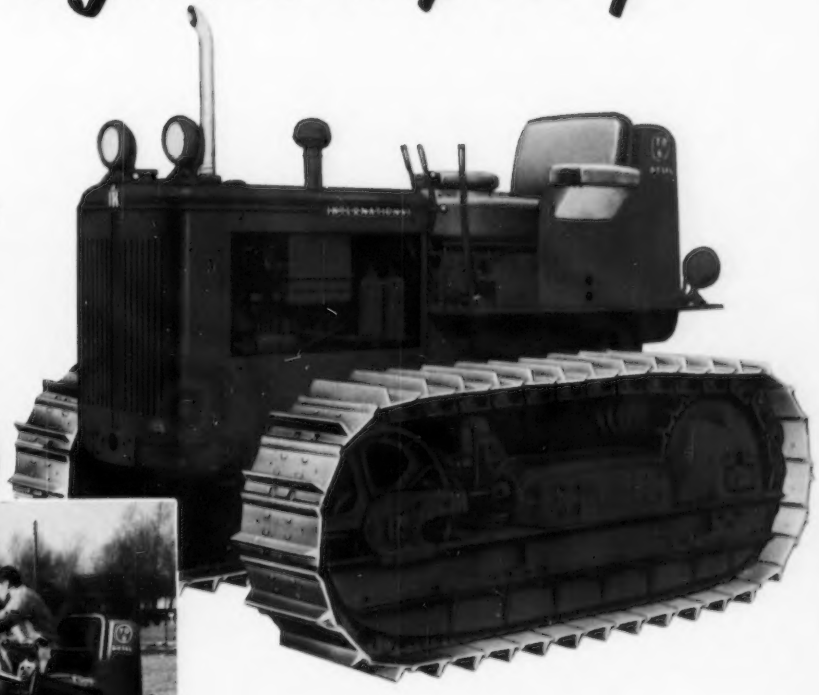
Now . . . 500-hour lube intervals with new metal-to-metal, track roller seals! You save the time and expense of frequent inspections or lubrications, with the new *full-floating*, cartridge-type, track roller seals provided on the TD-24, TD-18, and TD-14. These precision-lapped, metal-to-metal seals are so effective they give you *safe* 500-hour intervals between roller lubrications!

Steps up a size... in job range and capacity!

50 Net Engine Horsepower. In International Drott Machines, Engine develops 55 Net Horsepower.

61 Series

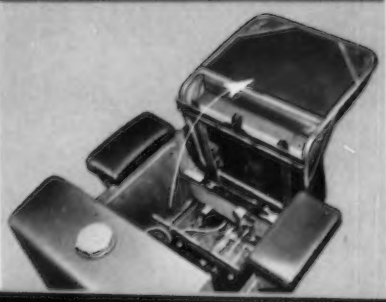
TD 6



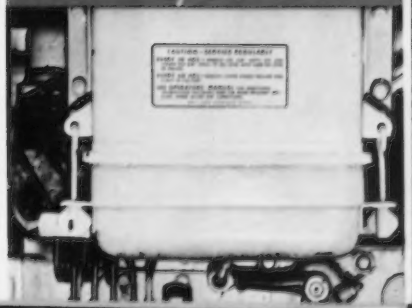
TD-6 diesel (series 61), 41.5 drawbar hp, up 23%! Steps up a whole size in work capacity and earning ability. Operating weight (5-roller model), without equipment, 8,890 pounds. Powers 1-yard International Drott Skid-Shovel or Four-In-One; serves as clean-up dozer unit on any-sized contract; versatility and low operating cost to do many sizes of jobs for every size of contractor.

Full-view, one-glance panel saves time—cuts effort! One quick glance at this new full-view panel, with centralized instrument grouping, gives the operator the instant check-up, to assure that lubrication, generator, and cooling system are "perking" for full production!

New Fold-over Seat Aids Fast, Centralized Servicing! New fold-over seat of the TD-6 and TD-9 models allows operator to give you the time and convenience advantages of centralized steering clutch assembly servicing. Lubricant fittings are conveniently grouped and fully accessible!



Thorough air filtration assured by new under-hood cleaner! Instead of being "in your lap," or a knee-bumping obstruction, air cleaners of the new International crawlers are side-mounted—for easy accessibility, yet out of the way. They have big capacity and high efficiency, too, for positive air filtration!



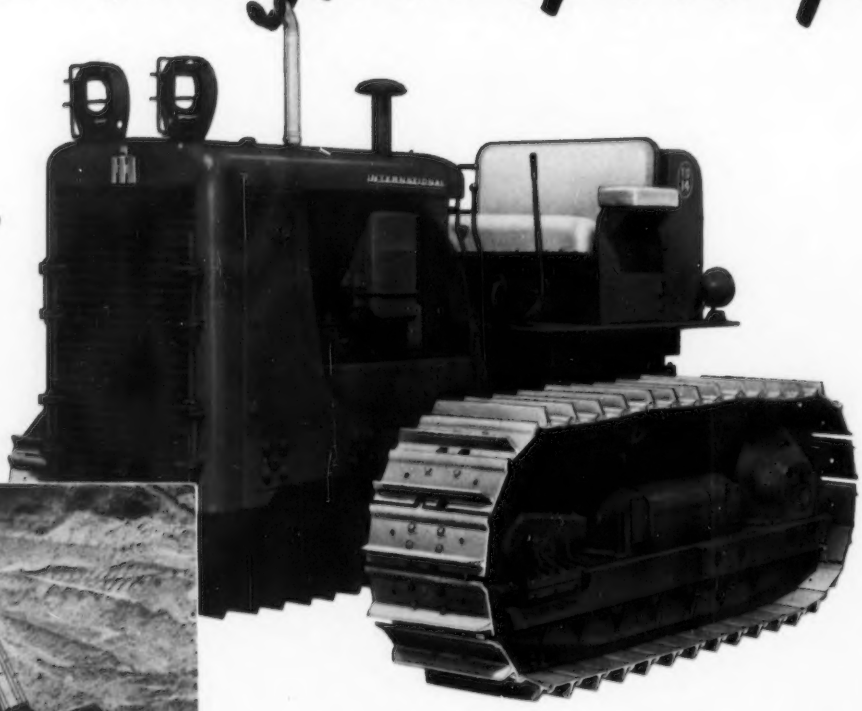
International® Crawlers gi

plus new design to speed yo

95 Net Engine Horsepower.

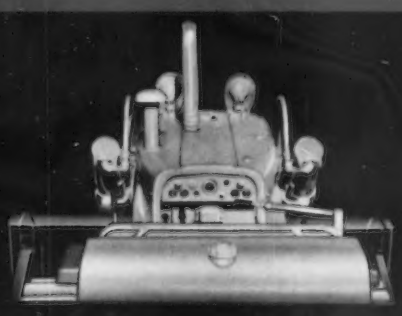
142 Series

TD 14



TD-14 (series 142), 78.5 drawbar hp; weighs 21,095 pounds (without equipment). Features "new look" engineering, job-speeding visibility, new equipment-carrying and operating strength. All-weather electric starting, standard equipment. It's a fast, responsive, big-capacity dozing tractor. Powers 2¼ cu. yd. International Drott Skid-Shovel or Four-In-One; 15-ton capacity Superior Pipe-Boom; other similar-sized equipment.

Central Tower Visibility adds operating efficiency! See how new International crawlers are streamlined for complete job-control visibility. Seat is amply high to provide full view of equipment, terrain, and variations requiring operator action, to maintain efficiency.

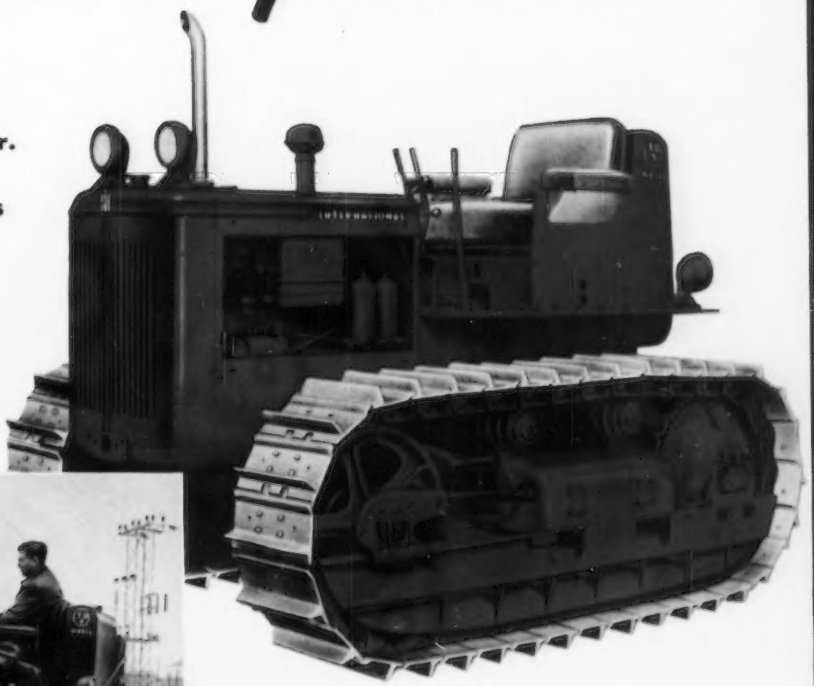


Clean, safe deck cleared for action! Look down on that safe, clean, flush deck—a platform for full production. The wide, man-size seat is fully-adjustable; rubber padded. Instruments centralized for one-glance check-up! Even a cigarette lighter is provided, to prevent careless stops!

Pressurized Closed Cooling System for Positive Performance Protection! New pressurized cooling systems provide fast warm-up under thermostatic control—and positive *ideal temperature control* with forced circulation through full-length jackets. That aids clean combustion, guards oil film strength, protects performance. Radiator core assembly is easily-removable, without disturbing radiator guard or mounted equipment.

...give you Bonus horsepower—...your jobs, control your costs!

66 Net Engine Horsepower. In International Drott Machines, Engine develops 71 Net Horsepower.



91 Series

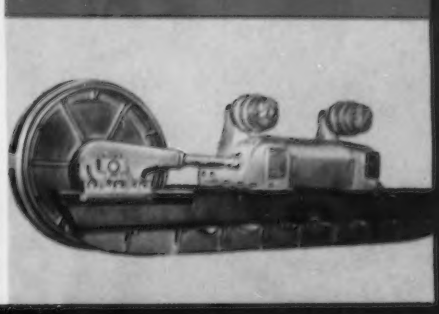
TD 9

TD-9 diesel, (series 91), delivers 54.5 drawbar hp—up 32%. Operating weight (5-roller model), without equipment, 12,000 pounds. Now up in a new heavy-duty job range. New power is backed by new power train and track frame strength, new operating and servicing ease. Powers International Drott 1½ cu. yd. Skid-Shovel and other equipment requiring similar power.

480-hr. full-flow lube oil filters guard bearings, cut upkeep! Every drop of oil on its way to lubricate moving engine parts must pass through these new abrasive-trapping micron-type filters—with the capacity, strength, and efficiency to give 480 hours of wear-fighting, upkeep-cutting duty!

Hydraulic Power Steering Inspires Operator Cooperation! New hydraulic power steering of the TD-14 and TD-18 cuts operator fatigue—and along with the other big effort-saving advantages, makes it easier than ever to deliver full-capacity production! TD-6 and TD-9 have spring boosters to lighten the operator's job.

"Bridge-strong" track frames for "slam-bang" conditions! You are looking at the strongest track frame in the industry for crawlers of TD-18 and TD-14 size! Heavy steel box-section beams, weld-joined to heavy stress-relieved steel plates—and rigidly gusset-braced—they're your foundations for record-making "rough-and-tumble" performance!



TD 24

The capacity leaders in their power class

Gear Drive Model, 190 Net Engine Horsepower
Torque Converter Model, 200 Net Engine Horsepower

Massive—with 43,080 pounds of rock-dozing, scraper-pushing brawn (7-roller torque converter model)*—the TD-24 can give them all a lesson in operating ease, big capacity, and positive load control! Has instant high-low range and exclusive Planet Power steering to give you its tremendous *pushing*, *pulling*, and *lifting* power on any terrain—with responsiveness not available elsewhere! *Live power on both tracks, on every turn!* Backed by equipment engineered to match its strength and power!

*Gear Drive 7-roller model weighs 42,780.

New International Attachments and Equipment team with new bonus-powered crawlers to give you high-producing performance packages: 42 new Bulldozers, to fit your needs exactly . . . 4 new Drott Loaders, 1 to 3-cubic yard capacity . . . 4 new Superior® Pipe-Booms, 8 to 55-ton capacity; 3 job-proved PCU'S! . . . **Measure . . . compare . . . prove to yourself . . . new bonus-powered International crawler tractors beat anything else on tracks! Try this turnpike-paced new power for capacity, operator preference, profit potential. Ask your International Industrial Power Distributor for a bonus-powered demonstration to *your specifications!***

INTERNATIONAL HARVESTER

International Industrial Power

INTERNATIONAL HARVESTER COMPANY, 180 N. Michigan Ave., Chicago 1, Illinois

A COMPLETE POWER PACKAGE INCLUDING: Crawler, Wheel, and Pipe-Boom Tractors . . . Self-Propelled Scrapers and Bottom-Dumps . . . Tractor and Rubber-tired Loaders . . . Diesel and Carbureted Engines . . . Motor Trucks.

Bearings of the Future for Machines of Today

Rollway Maximum Bearings are used in the McDonnell Voodoo Jet

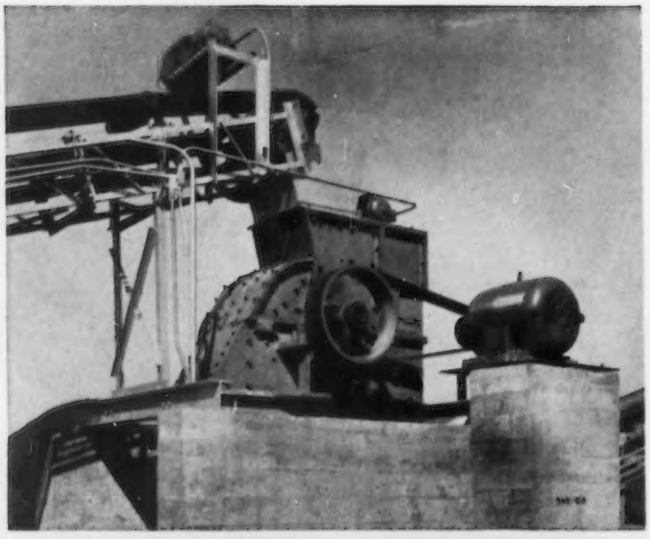
Gunned by higher speeds and higher temperatures, the performance demand for anti-friction bearings rises sharply every year. Here at Rollway, we strive always to keep abreast of the trend, and even to anticipate it. In precision, dimensional stability and simplicity, Rollway Maximum Bearings offer performance based on advanced thinking to original equipment and replacement buyers of today.

Start now, up-grade both your production machinery and your products with Rollway *bearings of the future.* Rollway Bearing Company, Inc., Syracuse 4, N. Y. Manufacturers of a complete line of radial and thrust cylindrical roller bearings.

ROLLWAY®
Maximum
ROLLER BEARINGS

ENGINEERING OFFICES: SYRACUSE • BOSTON • CHICAGO • DETROIT • TORONTO • PITTSBURGH • CLEVELAND • MILWAUKEE • SEATTLE • HOUSTON • PHILADELPHIA • LOS ANGELES • SAN FRANCISCO

Jeffrey Mud Hog Crushers end plugging problem

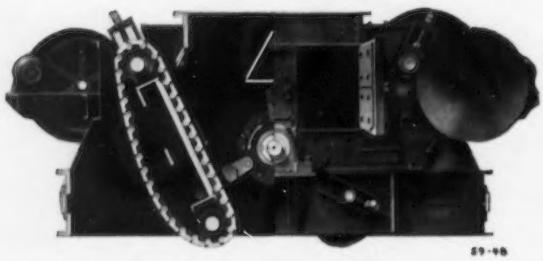


Heavy Duty Mud Hog Crusher reducing wet, sticky clay. Jeffrey belt conveyors feed the raw material to crusher and deliver crushed product to processing plant.

Jeffrey Mud Hog Crushers are specifically designed to crush all types of wet, sticky materials *without plugging* when fed at a uniform rate in proportion to their capacity ratings. Adjustable traveling manganese steel breaker plates convey the material directly into the path of the hammers, and discharge at the bottom. Heavy steel construction provides maximum reduction with minimum wear.

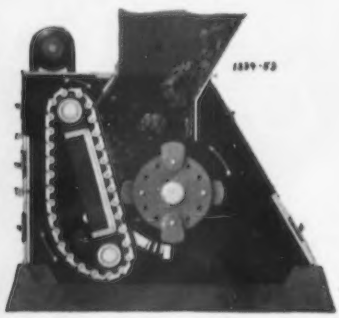
WIDE RANGE OF SIZES

Jeffrey Mud Hog Crushers are built in single direction types in various sizes for medium and heavy duty service, and in heavy duty reversible types. They are giving highly satisfactory service in brick and clay plants, chemical plants, power plants and other related industries. Complete specifications on these machines are contained in the new Jeffrey Bulletin 864.



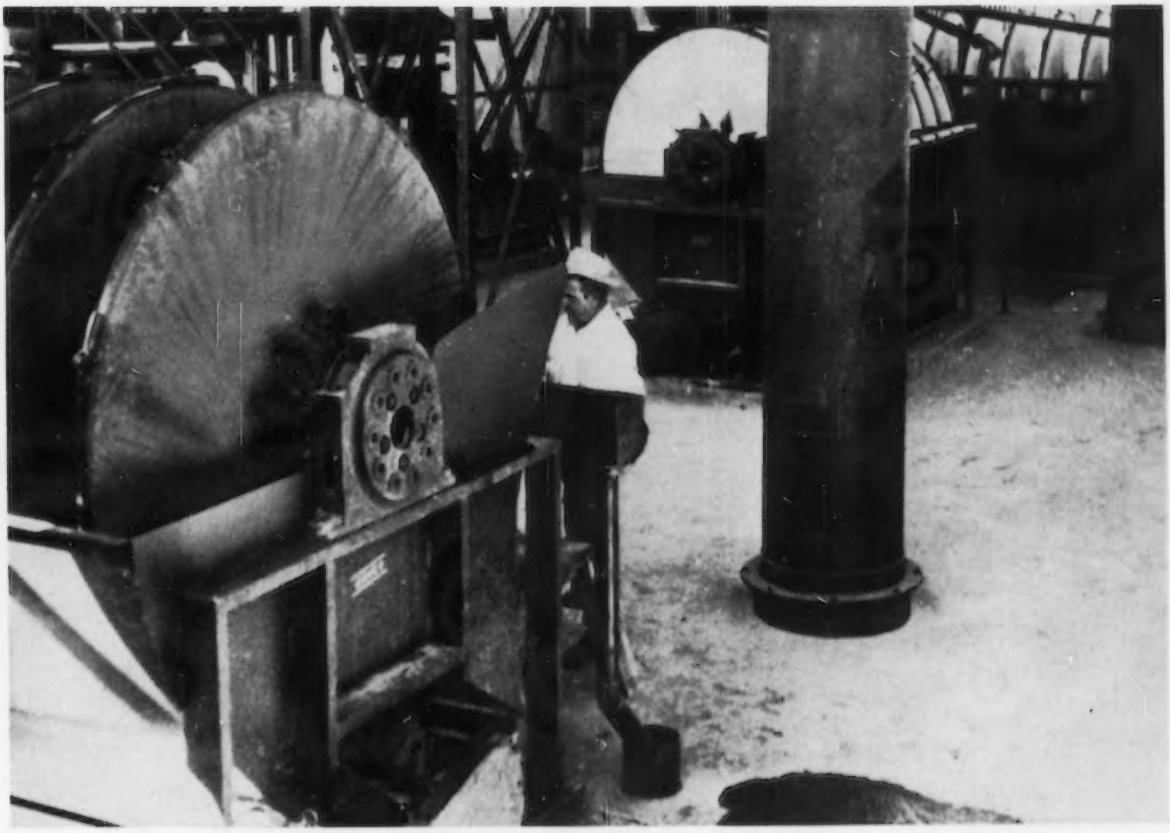
Cross-section of Heavy Duty Reversible Mud Hog Crusher, equipped with two traveling breaker plate assemblies and reversible rotor.

Cutaway view of Medium Duty Mud Hog Crusher at work on coal, which can be reduced to 85 minus ⅛". Note clean-sweeping action of hammer travel.



JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT • TRANSMISSION MACHINERY • CONTRACT MANUFACTURING



EIMCO AGIDISCS REDUCE MOISTURE IN COPPER CONCENTRATE

Uniformity of cake formation produces higher tonnages at lower moisture

Recent installations of Eimco Agidisc Filters show the superiority of this equipment in dewatering metallurgical concentrates.

One installation on a copper concentrate with an 80% minus 326 mesh feed has been dewatered to a moisture content of approximately 12%. This installation will produce approximately 260 lbs. per square foot per hour when it is in full operation.

The Agidisc provides a smooth, evenly distributed cake on the sectors. The cake moistures are even over the surface of the disc because the particle sizes are evenly distributed. On the Agidisc you completely eliminate (1) thin feathered edges of cakes near the sector bell, (2) heavy, soggy classification rings near the periphery of the sector. (3) Classified materials in special belts around the sectors as per particle size, (4) scrubbing media in or through channels cut in fast settling slurry deposits in the bottom of the filter tank.

Only Eimco makes the Agidisc — Investigate the extra values of using this filter on your dewatering problems.

THE EIMCO CORPORATION

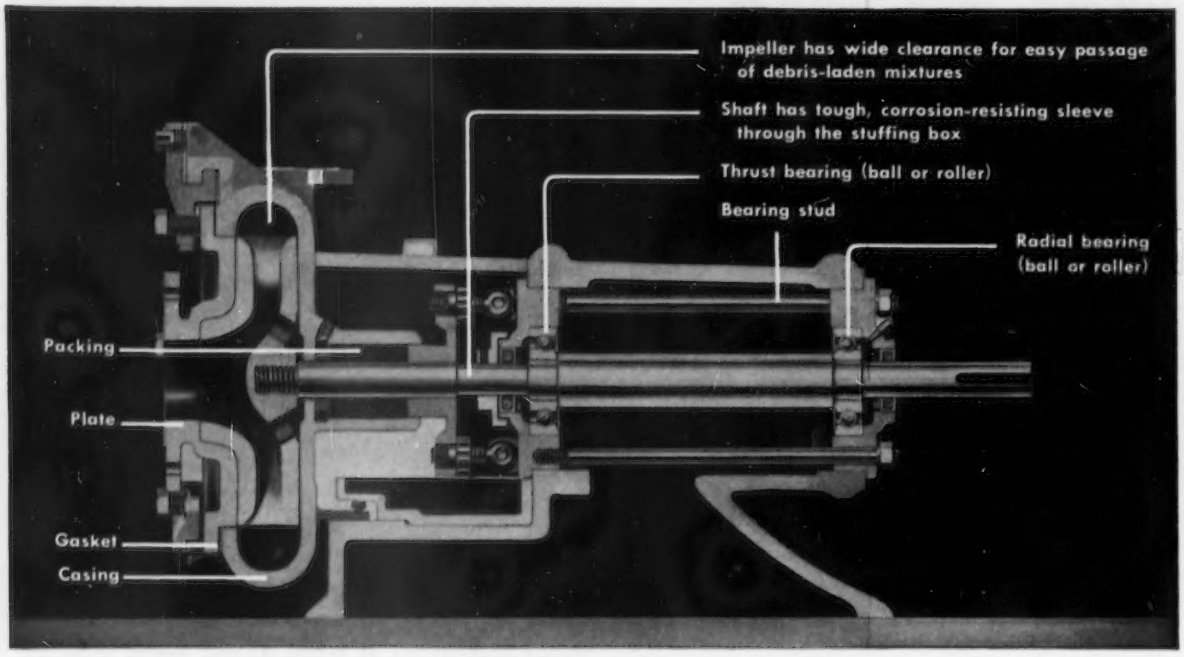
Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-185

AMSCO® PUMPS

job-rated for grueling service



Compact design of Amsco Mining Pumps is shown here. There are only 3 parts (casing, impeller and end plate) exposed to the grinding flow of abrasive or erosive materials.

Amsco pumps stay on the job longer because they're designed especially to handle pump punishing materials such as abrasives or heavy solids.

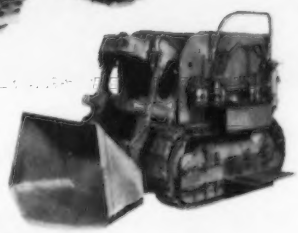
Special wear-resistant metals are used in Amsco pump parts so they will stand up longer in abusive service. And, when repairs are needed, you'll save on labor costs because Amsco pumps are compactly designed. It takes fewer man-hours to disassemble and assemble Amsco pumps because of their simple design.

An Amsco pump specialist, with experience gained in many different installations, can help you analyze your operation and recommend the type of Amsco pump best suited for your application. Standard size Amsco pumps range from 6″ to 16″ discharge openings. Larger sizes are also available. Write for Bulletin No. 548IP which gives specifications and complete data on the Amsco pump line. Amsco also manufactures a complete line of hardfacing welding equipment…both rods and machines.

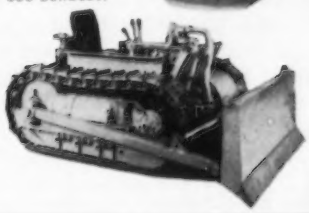
AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Ill.

630 Tractor



630 Loader



630 Bulldozer

Load Trucks Faster Underground

Eimco 630 crawler loaders speed up the mucking cycle underground because they can load trucks or other haulage equipment from any angle at an average speed of three tons per minute.

The 630 provides new flexibility underground with crawler and rubber tired equipment operating in trackless headings. The 630 is also ideal for drawpoint loading in mines where track haulage is already operating.

Spreading fill or pushing broken rock in big stopes provides an ideal situation for the 630 with bulldozer attachment.

All of these applications make use of the Eimco 630 which is a heavy-duty air or electric powered unit providing maximum production efficiency with minimum cost in maintenance and operation.

The 630 is the answer to dependable trackless mining. An Eimco engineer will answer any questions you may have about this machine and arrange for you to see the 630 in operation.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-186

PROLONGED CONFINEMENT COUNTS

...keeping explosives at work behind the burden

A 100 ft. face . . . solid rock. A 7-hole "alternate pattern" ROCKMASTER shot. At ⅕ second, note how confined explosives force is stressing and shattering rock. Only leaks visible: a few small puffs of gas. Here's real blasting efficiency!

Bottom initiation confines blast. At 1 second, explosives still are hard at work behind burden . . . pushing it out from face. No wild flying rock. No spouting geysers of escaping gas.

Prolonged confinement pays off! No loud air snap. Vibration held to a minimum. Good, controlled throw. Here's a well-displaced 25,000-ton muck pile . . . well broken . . . ready for removal.

PROLONGED CONFINEMENT—the Rockmaster® way

Here's an outstanding example of blasting efficiency. The explosives are hard at work shattering rock . . . not air. The blast pays off by giving faster removal of the overburden . . . in economies all along the line.

Secret of this good shooting is *prolonged confinement*. The blast, initiated at the bottom of the holes with ROCKMASTER millisecond delay electric blasting caps, is confined behind the burden. It's the right combination of ROCKMASTER blasting caps and Atlas explosives that gives—

- **good control**
- **improved breakage**
- **greater efficiency**
- **better public relations**

To get the most out of your blasting methods and your explosives, discuss prolonged confinement with your Atlas representative. You can benefit by his ideas and experience. And get "Better Blasting"—Atlas' informative newsletter on latest methods and materials. Write us to put your name on our mailing list today.

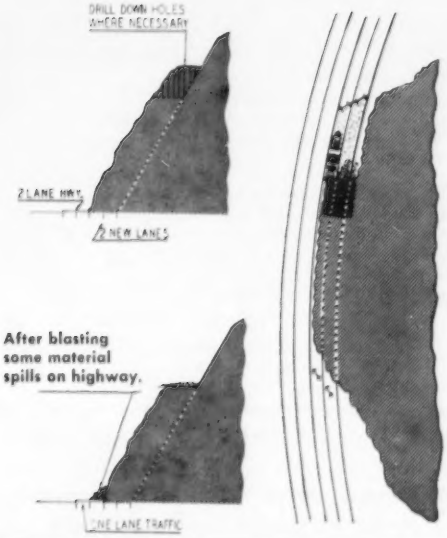
EXPLOSIVES DEPARTMENT

ATLAS POWDER COMPANY

WILMINGTON 99, DELAWARE

offices in principal cities

Highway Widening Jobs Need Not Obstruct Traffic



Contractors can take highway widening jobs without building bypass roads to carry traffic.

The busy highway shown above is being widened from two lanes to four lanes using the method described at left.

The problem was solved by keeping the trucks and excavating equipment off the highway so that it remained open for traffic except at intervals when shooting was necessary.

The Eimco 105 Tractor-Excavator was ideally suited to this type of job. It loads large trucks full from the end and cleans up the big boulders quickly. With the Eimco operating in a straight line, forward to dig and load and reverse, with the bucket moving overhead, to discharge.

Digging in dirt and consolidated material can often be accomplished without blasting the material at all. The Eimco 105 will load in dirt at the rate of 10 yards per minute and in rock the rate of loading is 6-7½ yards per minute depending on the material.

Eimcos are heavy-duty machines built to handle the toughest kind of jobs. They can apply more thrust force at the digging lip than larger equipment costing several times as much.

Write for complete information on Eimco 105 Tractors.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

EIMCO

B-187

VIBRATING PAN IS THE ANSWER!

Simplicity OS-A-VEYOR feeders lower maintenance and increase operating efficiency . . . LIMESTONE to TACONITE ORE

These Simplicity vibrating pan type feeders have proven themselves throughout the mining and quarry industry. They are not only handling various types of stone and aggregate, but the extremely abrasive taconite ore.

Lower maintenance costs have been proven by long experience in the field. The simplicity of the pan construction allows the unit to be easily repaired with existing materials. These feeders are available with replaceable liners of abrasion resistant steel. The oscillating action is provided by two eccentric shafts coupled to a single V-belt drive . . . leaving only one assembly and four bearings to lubricate.

The Simplicity Os-A-Veyor feeders are self-cleaning units. They experience none of the return spillage found in apron feeders. The Os-A-Veyor feeder will discharge material with a minimum fall, the height of drop is not determined by the size of a sprocket. The units are designed to handle heavy column loads. Overloading the feeders causes no damage, as there is no mechanical connection between the eccentric drive and the main frame or bin.

The Simplicity Os-A-Veyor feeders are main frame supported, or can be supported from the bin with spring and cable suspension, eliminating the need for separate concrete foundation. Sizes available range from 1' x 4' to 6' x 20' with capacities to 1000 tons per hour.

169

If you wish further information on Simplicity Os-A-Veyor feeders, grizzly feeders, horizontal screens or gyrating screens write . .

SALES REPRESENTATIVES IN ALL PARTS OF THE U.S.A.
FOR CANADA: Simplicity Materials Handling Limited, Guelph, Ontario
FOR EXPORT: Brown and Sites, 50 Church St., New York 7, N. Y.

Simplicity
TRADE MARK REGISTERED
ENGINEERING COMPANY • DURAND 4, MICHIGAN

How ONE MAN and ONE MACHINE saves you money on mine exploration

The HIGH-SPEED, self-loading D Tournapull has the versatility needed to speed all the exploratory phases of your mine development. This job-proved unit moves in or around any location at speeds up to 28 mph. It cuts grades accurately, hauls anywhere, and spreads in controlled layers. Its big tires effectively compact material. Where land restoration is required, the "D" is ideal for segregating topsoil, refilling and landscaping. Where ore-bearing soils are to be tested, the 138 hp "D" will self-load over 5 bank yards per trip for quick delivery to screens or hopper. Where dams or reservoirs are needed for water supply — ditches or sluiceways for drainage — the "D" moves in, gets the job done fast, and moves on to the next task without delay.

Big low-pressure tires, positive power steer and a unique power-transfer differential enable Tournapulls to travel slippery saddleback roads or through deep mud and sand which would stall an ordinary truck. Electric scraper and steer controls and a foam-rubber seat give easy operation and easy riding in tough going. These are but a few of the reasons why this fast utility tool speeds search and pilot tasks, cuts costs, and eliminates many inconveniences of exploratory operation. It will pay you to learn more about what it can do for you.

Tournapull—Trademark Reg. U.S. Pat. Off. DP-58-M-bw

The self-loading "D" handles all these jobs:

- Clears, levels sites for camps and drill setups. Eliminates cost of expensive cribbing.
- Strips surface material to expose bedrock. Gives you better access to formation.
- Builds, maintains and gravels access roads. Fills roads across soft, low areas.
- Loads, hauls material from open pits in 9-ton (7-yard) scraper.
- Hauls in supplies. Carries loads over terrain no other wheeled vehicle can cross.
- Levels building sites. Digs sludge basins, drainage ditches and sluiceways.
- Moves into any site under its own power — over pavement or cross-country.
- Supplies electricity for emergency lighting or temporary equipment operation.
- Plows snow from supply roads. Self-loads, hauls snow, ice from camp sites.
- Dozer blade available. One man can do clearing, build roads, drain, grade and strip.

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

Amazing new electronic "inspector" detects slightest imperfections in wire rope

This new inspection machine literally "sees through" wire rope and detects any imperfections that may occur in the manufacturing process. It inspects every inch of rope, 360° around, and *all the way through!* If an imperfection occurs, the machine instantly records it on a chart, squirts paint on the rope, lights a light and alerts the operator to correct the flaw.

In the preliminary tests using wire rope containing specimen broken wires, the electronic "inspector" proved 100% effective. It didn't miss one. These tests prove to us that this device will give the regular inspector a superior tool which will work continuously and will "see" all.

To our knowledge, American Steel and Wire Division is the first wire rope manufacturer to recognize the possibilities of this electronic inspection device as an *extra* step in quality control that will assure better, more uniform wire rope.

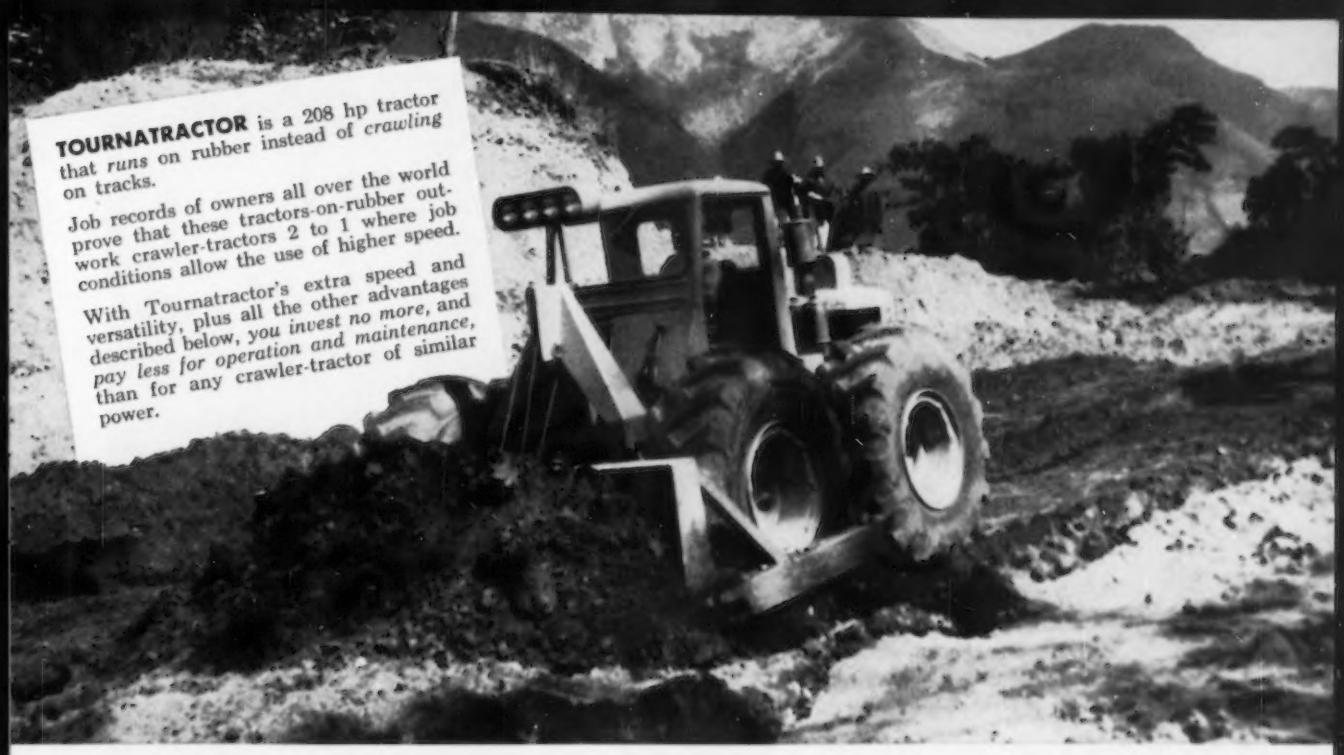
AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

USS

UNITED STATES STEEL


TOURNATRACTOR is a 208 hp tractor that *runs* on rubber instead of *crawling* on tracks.
Job records of owners all over the world prove that these tractors-on-rubber outwork crawler-tractors 2 to 1 where job conditions allow the use of higher speed.
With Tournatractor's extra speed and versatility, plus all the other advantages described below, you *invest no more*, and *pay less for operation and maintenance*, than for any crawler-tractor of similar power.

Does speed fit your job?

Check these tractor advantages

19 mph forward . . . 8 in reverse

Tournatractor pulls, dozes, pushes at working speeds 2 to 3 times faster than crawler-tractors. You change gears instantly, waste no time shifting, move up to 8 mph in reverse. Torque converter provides the equivalent of an infinite number of gear ratios, automatically selected to balance load and torque.

Drives to work . . . anywhere

Tournatractor travels at speeds to 19 mph from job-to-job. Big, low-pressure tires drive anywhere without need for planking, trailers, loading or unloading.

Simple . . . less maintenance

Lubrication takes less than 5 minutes on Tournatractor, compared to 15 minutes or more on a crawler. Cleaning of tracks and fittings is eliminated. Self-cleaning tires last 2 to 3 times longer than tracks.

Anti-friction drive

208 hp diesel drives through dirt-sealed anti-friction bearings to free-rolling wheels. There is no grinding wear of sand, dirt, and mud as in driving with multi-part crawlers.

Provides emergency electric power

Flywheel-mounted generator produces electricity to operate blades and PCU, and in emergencies you can tap into this handy electric source for floodlights, power tools.

Easier to operate

Less jolt and jar on low-pressure rubber tires reduces stress and strain on both operator and machine. Simple electric controls permit operator to work faster, with less end-of-day fatigue.

Improves safety

Low center of gravity, all-around visibility, accessibility, and quick response of electric controls make Tournatractor exceptionally safe to operate. Its multi-disc air brakes have *four times* the braking surface of most big tractors and trucks.

Interchangeable equipment

Bulldozer, Angledozer, Root Rake, Snow Plow, Snow Wing, Push Block, Logging Winch, Tree Pusher, are also available.

Ask your LeTourneau-Westinghouse Distributor to help you analyze specific Tournatractor applications on your work. No obligation!

Tournatractor, Angledozer — Trademark Reg. U.S. Pat. Off. T-941-M-b

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

"Two shifts a day for more than two years

. . . and with only a few minor repairs. We're completely satisfied." That's the report from Societa Talco e Grafite Val Chisone operating Mancha Little Trammers in their talc mine in northern Italy.

In other mines, Little Trammers have reduced the cost of tramming as much as 75 per cent . . . and, often do work both men and animals find impossible. Neither climate, altitude nor poor ventilation can slow them down.

Mancha Little Trammers are small enough for narrow drifts, easily transferred from level to level. They not only handle heavy ores and waste with ease and economy, but are also used for moving mucking machines, drill jumbos, timber, supplies, and men.

They are made to last for years, are safe and easy to operate. That's why Little Trammers pay for themselves through savings in a very short time. They'll do the same for you, too.

Write us for complete information.
No obligation.

MANCHA

STORAGE BATTERY LOCOMOTIVE

DIVISION GOODMAN MANUFACTURING COMPANY

Halsted Street and 48th Place • Chicago 9, Illinois • Cable Address: Mancha, Chicago
Mancha representatives are located in principal mining areas throughout the world.

New "B" Rear-Dump offers you big capacity PLUS

High speed

B Tournapull Rear-Dump has forward speeds from 2 to 34 mph, plus two reverse speeds, 2 and 4 mph. Wide selection of speeds enable "B" to climb steep grades.

Easy loading

Loading of new "B" is made easier by large "target" area of bowl. Its 17′8″ length, 10′2″ width, and 7′6″ depth make it ideal for any size shovel. Rear of body provides wide, low entry for dipper to give extra speed advantage for the excavator. Big 35-ton capacity can make every load a profitable one.

Fast dumping

At the touch of a dashboard switch, body raises to vertical position. Edge of bowl swings behind and below rear wheels so rocks cannot roll forward to lodge against wheels nor can material pile under rear end.

180° turn in 35′ space

Two wheel prime-mover turns 90° right or left . . . machine in normal use makes non-stop 180° turn in space only 35′ wide. With body in dump position, machine can turn 180° in only 27′. This maneuverability of "B" allows you to work in tight quarters where smaller conventional haulers often cannot go. Jockeying back and forth to get into loading position is eliminated.

7536 square inches of braking surface

Heavy-duty air brakes with 7536 sq. in. of braking surface improve maneuverability . . . add to operator confidence for faster operation on steep grades and narrow winding haul roads.

New "B" also offers these additional features

- Big 7-ft. high 2-ft. wide low pressure tires for better flotation.
- Rugged body construction for longer equipment life.
- Simple, positive electric controls for fast, easy operating.
- Lower maintenance because there are no hydraulics, no long driveshafts, no springs or spring hangers.

For more information on this big new "B" Rear-Dump see your LeTourneau-Westinghouse Distributor.

Tournapull — Trademark Reg. U. S. Pat. Off. BR-888-G-b

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

. . . from the ARCTIC to the EQUATOR

. . . from the FAR EAST to CONTINENTAL EUROPE

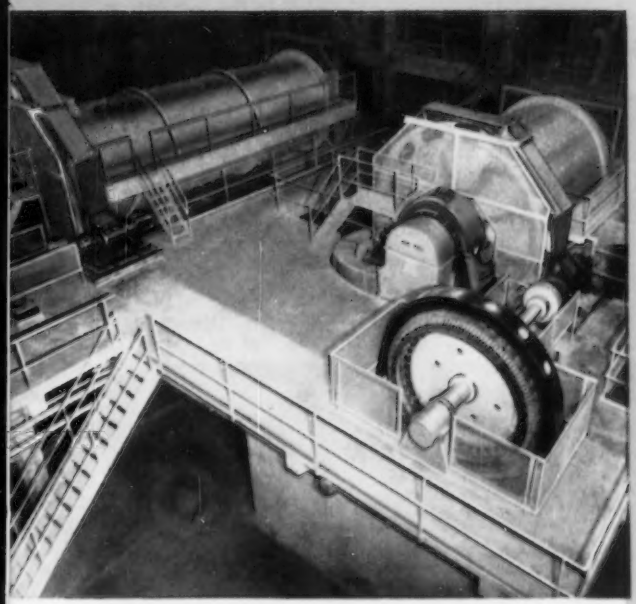
NORDBERG

are Industries' choice for the efficient

These six Nordberg 10'8" by 17' wet grinding Ball Mills efficiently serve a large Taconite reduction plant.

GRINDING MILLS

reduction of ORES, CEMENT and MINERALS



These two views show eight Nordberg Grinding Mills used for raw and finish grinding in the plants of a leading cement producer. Above is a 10'8" by 16' Ball Mill and a 9'6" by 32' Compartment Mill. Below are two 10'8" by 17' and two 9'6" by 11' Ball Mills, together with two 8'6" by 36' Compartment Mills.

MORE than half a century of progressive engineering achievement, combined with quality production in modern manufacturing facilities, have won for Nordberg a foremost position in the field of heavy machinery manufacture.

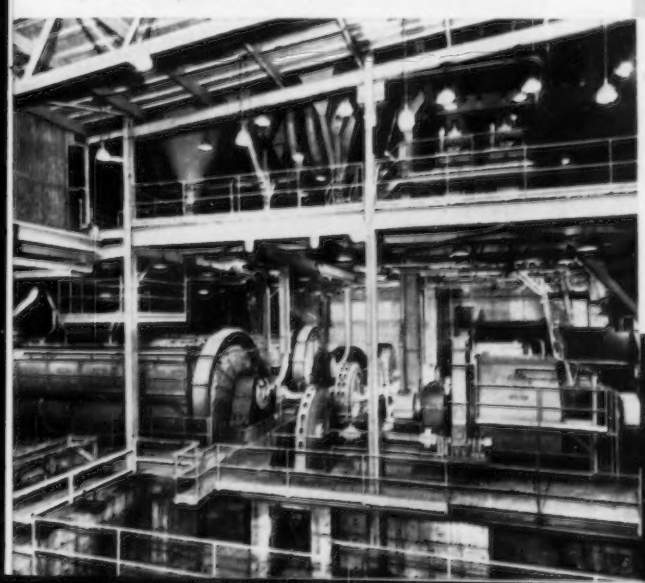
This is evidenced by the universal acceptance which Nordberg Machinery has received by most of the Mining and Mineral processing industries throughout the world.

Typical of this heavy machinery is the complete line of Nordberg Grinding Mills for raw and finish grinding of cement materials, the fine reduction of metallic and non-metallic minerals and for numerous other processes where friable material must be comminuted to fine sizes.

Nordberg manufactures Ball, Tube, Rod and Compartment Mills, of grate, overflow and peripheral discharge types for wet or dry grinding service, in sizes ranging from 6 feet to 13 feet in diameter, and up to 50 feet in length.

For large or small operations, you can depend on Nordberg Machinery to deliver maximum output at lowest possible cost. Write for further information. *NORDBERG MFG. CO., Milwaukee, Wis.*

SYMONS . . . *a registered Nordberg trademark known throughout the world*



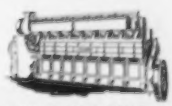
SYMONS GYRATORY CRUSHERS

SYMONS CONE CRUSHERS

SYMONS VIBRATING GRIZZLIES and SCREENS

SYMONS V-SCREENS

NORDBERG KILNS and COOLERS



NORDBERG DIESELS—10 to over 12,000 H.P.

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GM15

NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • DULUTH • WASHINGTON
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how to get the most out of HOLLOW DRILL RODS

Cutting drilling costs takes three things – quality drill steel, good shop practice, and care in the field.

The requirement of quality steel has been well taken care of by new *alloy* rods – Crucible CA DOUBLE DIAMOND and 4E Hollow Drill Rods. But even the best, toughest steel requires some care.

Take, for example, FORGING AND HEAT TREATING

Outside of breakage caused by down-right *abuse*, most hollow drill rod failures are caused by improper forging or heat treating.

Failures due to heat treatment are generally fatigue failures occurring in the region of the rod where the forging, normalizing or hardening heat runs out. This is the "soft-zone" between the part of the rod that is heated to the desired temperature and the part that remains cold. To eliminate unnecessary failures, it is important that manufacturer's data sheets or field representative's recommendations be followed closely.

ANNEALING – If any forging is performed prior to machining, the end should be allowed to cool in air until black. It should then be reheated to slightly above critical temperature and allowed to cool slowly in a good insulating material such as mica or ground asbestos.

A good practice is to put the rods in the insulation early in the afternoon, and allow them to cool slowly until the next morning. When the rods are removed the ends should still be too hot to handle comfortably with the bare hands.

As a leading producer of drill steels, and other special purpose steels, Crucible welcomes the opportunity to work with you in solving problems as they arise.

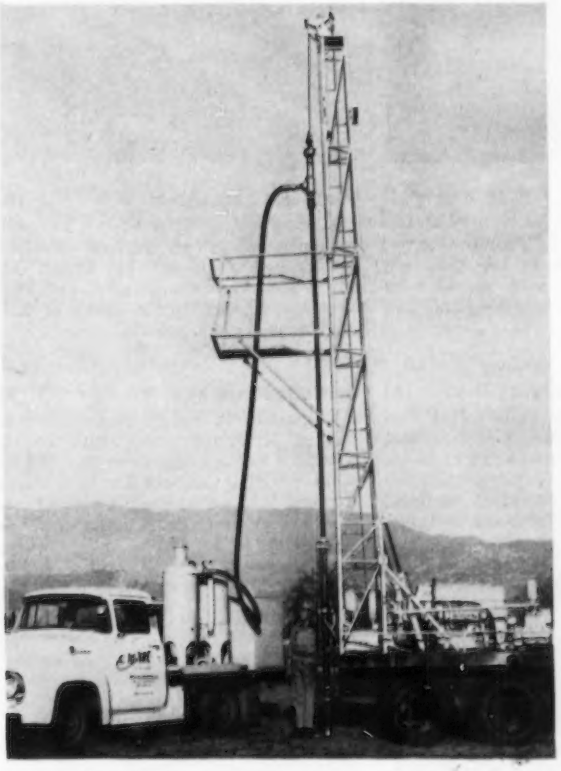
Call your nearby Crucible representative for help with any phase of drill rod care or operation – or for *prompt* deliveries of hollow drill rods in the sizes, types and grades you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

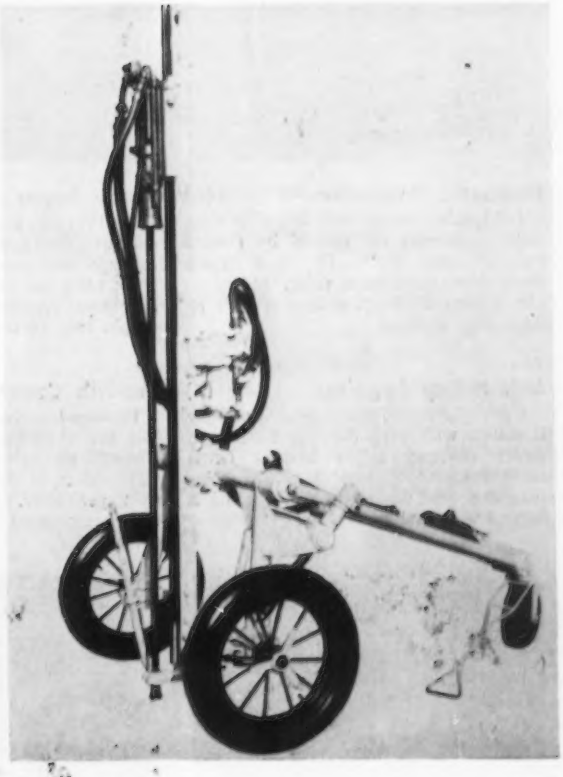
E&MJ NEW PRODUCTS DIGEST

LLOYD E. ANTONIDES, Assistant Editor



Air Flush Unit (1)

Claimed adaptable to any rotary drill rig, Hi-Vac system by American Exploration Co., Santa Susana, Calif., sucks cuttings out drill stem by air. It is said to be more efficient than normal air flush and to be practical to 2,000 ft in dry holes. Unit shown is mounted on separate truck for demonstration.



Wagon Drills (2)

Newly designed mast and grouping of all controls on a repositionable chain-feed motor are features of Wagon drills by Thor Power Tool Co., Aurora, Ill. SW-1 "baby" rig shown has mast that can be turned end for end to compensate wear, adustable height chassis for low lifters and full swing and dump.

◄ Core Drill (3)

Designed specifically for mineral prospecting, Hillbilly core drill has no frills or fancy gadgets says Acker Drill Co. Inc., Scranton, Pa. Stripped to bare essentials, rig weighs only 670 lb complete with heaviest single component 180 lb. It is claimed a rugged yet inexpensive drill. Capacity is: 1½-in. hole with ⅞-in. core to 450 ft; 3-in. hole with 2⅛-in. core to 250 ft. It has either hydraulic or screw feed drill head, 360 deg swivel type, and a 24-in. feed. It can be furnished on skids or for mobile jeep or truck mounting. Rig is powered by gasoline engine. Built-in circulating pump is optional accessory.

Soviets Have Electric Down-the-Hole Drill

Electric deep-hole rotary drill results are compared with a mud-powered turbine rig, both "down-the-hole" power units, in recent Russian publication Neftanoje Choisjaistov, according to McGraw Hill World News report from Vienna.

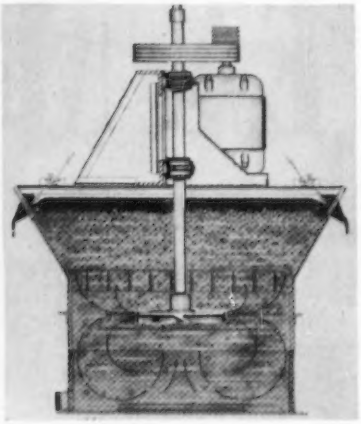
Five year experience shows some advantage for electric unit. Systems are called "work-place" type rather than the Western "down-the-hole." No similar rigs have received publicity in this country. Tuismasij oil field will be drilled with electric units, it is said.

Magnetic Separator (4)

Laboratory model high intensity magnetic separators are offered by Exolon Co., Towanda, N. Y. Dry feed stream flows over magnetized rotor. Magnetically graded discharge stream is split by knife-edge dividers.

Radio Pager (5)

Pocket radio paging receiver by Motorola Inc., Chicago, Ill., permits selective message transmission to key personnel in building or plant area. Actuated by telephone operator, transistorized unit weighs only 10 oz.



Flotation Machine (6)

Complete line of laboratory and production models of Airflow flotation machines are offered by Frank M. Murphy & Associates, Bartow, Fla. Pulp inlet and impeller are at center of cell. Air enters through spindle.

Belt Pulley Lagging (7)

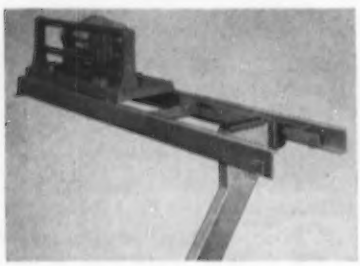
Conveyor belt slippage on drive pulley is solved with snow-tire like surface of pulley covering called Maltest Cross Double Chevron, says Hewitt-Robbins Inc., Stamford, Conn. Rubber lagging is backed with fabric.

Pre-Fab Conveyors (8)

Packaged conveyor units called Pre-Bilt are available from Link-Belt Co., Chicago, Ill. Belts are from 18 to 36 in. wide; drives, to 40 hp; capacities to 1,500 tons per hour. Standardized sectional units are claimed low cost and movable.

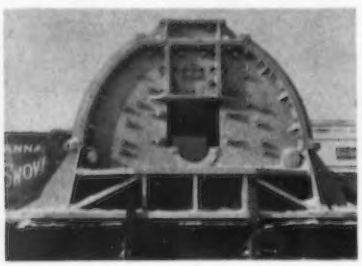
Screen Plate (9)

Conical or hour-glass shaped holes in thicker perforated plates with round, square or slot openings down to 0.001 in. make a rugged, efficient fine screen says Pyramid Screen Co., Boston, Mass. Finer sizes are electrolytically perforated.



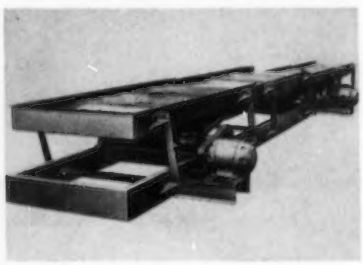
Automatic Sampler (10)

Designed for sampling in normally inaccessible places, automatic sampler with end carriage is made by Denver Equipment Co., Denver, Colo. Intermittently operated by motor-driven selective time switch control, cutter which rolls on track and is chain driven, passes across entire stream. Cover over mechanism of sampler protects it from dust and splash.



Impact Crusher (11)

Hy-Ton reversible impact mill includes several important design features which result in highest possible tonnage crushing at lowest cost, according to Crusher Engineering Div., Poor & Co., Philadelphia, Pa. Designed to give up to 700 tons per hour of a uniform size cubical product, it is said to feature, among other things, simplified maintenance and redesigned hammers.



Screen Conveyor (12)

IMCO balanced screen conveyors are said to provide extremely low cost screening or coarse sizing from ⅛ in. up, on ores, stone, sand and gravel. They are now available from Williams & Green, Clearfield, Pa., and are designed for smooth, easy operation without rigid, expensive mounting. Sections and models are furnished in best combination to fit particular job.

Tractor Starting Aid (13)

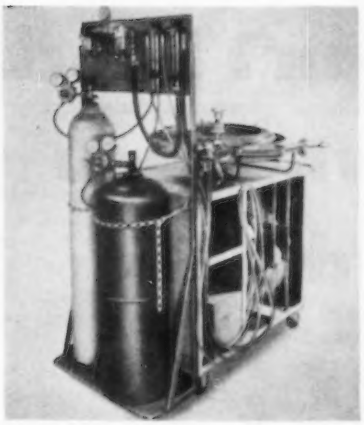
Vaporized ether injected into the air intake manifold is used in conjunction with glow plugs in direct electric starting systems for cold weather just announced by Caterpillar Tractor Co., Peoria, Ill., as attachments for D2, D4 and D6 tractors and No. 933, 955 and 977 Traxcavators. Ether capsule is used.

Remote Crane Control (14)

Electronic control system for overhead traveling cranes developed by Femco Inc., Irwin, Pa., uses only the two power trolley wires or rails. Carrier current over power circuit permits remote control from plant floor without added wires or cable controls. Control panel can be mobile mounted.

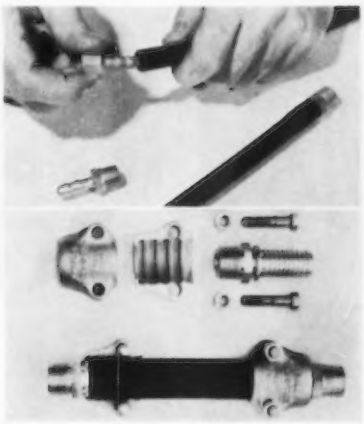
Radio Microphone (15)

Transistorized elements permit amplification in mircophone itself giving improved performance with CX-50 model according to Radio Corp. of America, New York, N. Y. It is designed specifically for two-way mobile communications and is interchangeable with existing carbon microphones.



Metallizing Shop Truck (16)

Metco Type WD, caster mounted truck, made by Metallizing Engineering Co., Westbury, L. I., N. Y., is designed to keep handy and ready to go all equipment required for metallizing.



Hose Fittings (17)

A push-on fitting for low pressure use on machine tools for air, water, fuel or lubrication lines, and a two-bolt clamp fitting for heavy duty have been developed by Flex-O-Tube, Inkster, Mich.

Spray Gun (18)

Spray gun P-CGA is claimed to have low cost and to need little air. Made by DeVilbiss Co., Toledo, Ohio, it converts from suction to pressure feed at flick of knob to fit spray material.

Welding Wire (19)

Designed for build up of parts, especially prior to final hardfacing. Automatic Buildup Wire for submerged arc welding is available from Air Reduction Sales Co., New York, N. Y. It responds to heat treatment and has high impact strength and wear resistance.

Self-Aligning Bearing (20)

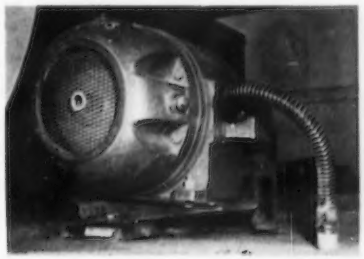
Clev-Align, continuous self-aligning bearing permitting up to ½-in. per ft variations, is offered as a low cost unit by Cleveland Graphite Bronze Co., Cleveland, Ohio. Other features stated include dirt-free operation and low operation and low installation cost.

Synthetic Hose (21)

Wider industrial use at high temperatures is suggested for lightweight, all-synthetic hose of Quaker Rubber Div., H. K. Porter Co., Phila., Pa., now used for 100-psi air at 400 deg F in keeping jet engines heated for immediate use. Sizes from ¾ to 5 in. are available.

Sealed Motor (22)

Moisture-, dust- and explosion-proof electric motor for mechanical drive applications is announced by Byron Jackson Div., Borg-Warner Corp., Los Angeles, Calif. Steel case is filled with medicinally-pure mineral oil which seals, insulates and lubricates. Especially designed for mining, various models are available from 20 to 450 hp.



Motor Base (23)

Tens-a-Matic pivoted motor base made by Murray Equipment Co. Inc, Detroit, Mich., automatically takes up belt stretch and matches tension to load. Variation of tension with load in lower tight belt gives varying moment of force which adds to moment of motor weight about adjustable pivot. Belt is changed simply by tipping motor forward.

DC Motors (24)

Kinamatic dc motors and generators are a completely new line announced by General Electric Co., Schenectady, N. Y. They are designed for versatile application and performance, have dripproof enclosure, lower armature inertia for faster response, Class B insulation and easier maintenance features. They are rated from 1 to 150 hp.

Conveyor Weigher (25)

Electro-Way, continuous weigher for belt conveyors, uses spring made of Ni-Span—temperature insensitive alloy of H. A. Wilson Co., Union, N. J.—to transmit motion from set of rollers to transducer for conversion into electrical signal. Compact, lightweight unit made by Commercial Prod Div., Bell Aircraft Corp. mounts right on conveyor frame.

Flow-Meter Feeder (26)

Immersed Float Vacuum Transmitter by Fisher & Porter Co., Hatboro, Pa., gives vacuum signal proportional to liquid flow in line. Signal controls feed of reagent. Primarily designed for automatic proportioning chlorinators, it is suitable for other applications. Virtually no maintenance is claimed as well as being unaffected by weather.

Water Vapor Recorder (27)

Unique instrument for continuously recording low concentrations of water vapor in air or gas streams uses thermocouples to convert heat energy—exchanged when a gas is adsorbed on or desorbed from surface of a solid adsorbent—into electrical signal. Esso Research & Engineering Co., and Mine Safety Appliances Co., Pittsburgh, Pa., developed it.

you can't knock it down if you don't drill it first

Easily-damaged, undependable cable is not cheap at any price. This is particularly true of open pit mining operations where the economical operation of much expensive equipment rests on its ability to keep working through each and every shift.

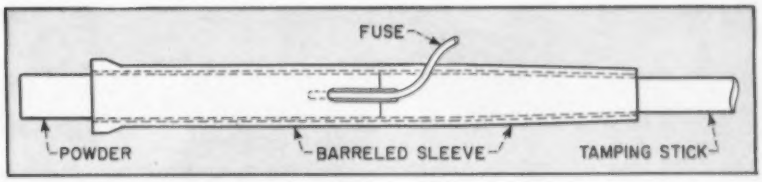
It is in such situations as this that TIREX Cables with their cured-in-lead, Selenium Neoprene Armor can mean the difference between a smooth-flowing job and one with stop-and-go operations. Only smooth-flowing jobs have low costs.

Portable cables are particularly subject to abuse and to deterioration from weather. Since they are the only pathway for power, isn't it just good common sense to buy the best portable cables you can find for powering your drills? That means TIREX, of course. TIREX has the toughest, most abrasion-resistant jacket available on a portable cord or cable. That's why we say be sure you specify and then be sure you get TIREX.

Simplex

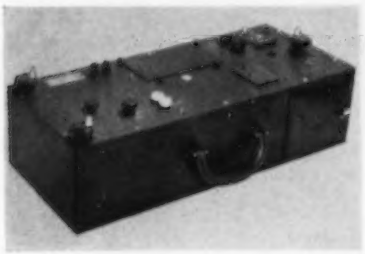
TIREX CORDS AND CABLES *are made only by the*

SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Mass.



Tamping-Loading Stick **(28)**

On end of this plastic tamping stick is slightly tapered tube to hold powder for loading hard-to-reach holes. Plastic Tamping Stick Sales, Iron River, Mich., is maker. At present, aid takes sticks up to 1¼ x 8 in. or longer.



Seismograph **(29)**

Portable blast and vibration seismograph offered by W. F. Sprengnether Instrument Co., St. Louis, Mo., photographically records three components of motion. It needs no external connections and is very simple to operate. Purchaser can keep permanent record of each blast as aid to planning and in countering litigation.

Radiation Detectors **(30)**

Raytomic geiger counters of Atomic Research Corp., Colorado Springs, Colo., are claimed to be more sensitive and lower cost through development of Bismuth-Jet chassis. Model ARC 231 shown is one of seven models which have different number of geiger tubes to give desired sensitivity, ARC 310 is 10 tube model.

Radiation Detectors **(31)**

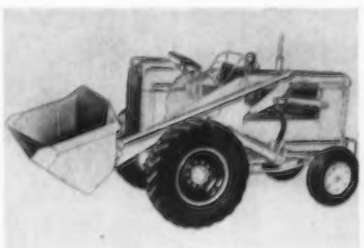
Nucleonic Co. of America, Brooklyn, N. Y., claims their Lokator line of uranium detecting instruments using multiplier tubes, cost considerably less than scintillation counters in sensitivity per dollar. They are more rugged, less affected by temperature and more reliable it is also said. R7A is reputed most sensitive detector made.

Ore Analyzer **(32)**

Neutron Adsorption Analyzer by Reed-Curtis Nuclear Industries Inc., Los Angeles, Calif., selectively detects and measures percent of elements having high adsorption cross section present in sample. Rare earths and precious metals are among the elements that are said to be quickly measured without the need for chemical treatment.

Tractor Loader **(33)**

Industrial loader line for Ford and Fordson Major Diesel tractors are announced by Tractor & Implement Div., Ford Motor Co., Birmingham, Mich. Buckets range from 9 cu ft to ¾ cu yd. Frame design allows operator to step on or off between upright and rear wheel instead of climbing over rear attached unit. They are easily installed, it is said.



Tractor Loader **(34)**

Tractomotive Corp., Deerfield, Ill., announce TL-11 Tracto-Loader as an addition to their line of front-end loaders. Designed for large capacity in confined areas, it has 1½-cu yd bucket, front wheel drive and rear wheel steering. As with all other Tracto-Loaders it has torque converter and clutch type transmission. Gasoline or diesel engine is available.

WHY AFCO

"ICDH" GRINDING BALLS GRIND 6 to 10% LONGER

"ICDH" means Improved Carbon Deep Hardened—and you'll avoid out-of-roundness, spalling, splitting, fast wear, and excessive downtime by using AFCO "ICDH" grinding balls. These balls have a hardness and toughness comparable with costly alloy balls. Here's why:

They are forged from steel produced to exacting chemical specifications, in our own hearths; consequently, we can test each ingot before rolling.

In addition, the right steel for each ball size is determined by hardenability testing. Automatic upset forging assures proper grain flow and produces the roundness needed for long, uniform wear.

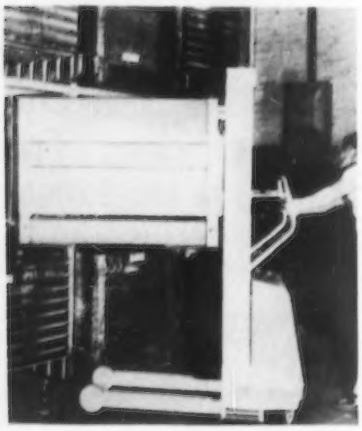
After forging, AFCO grinding media receive carefully controlled heat treatment to produce maximum hardness and penetration consistent with toughness.

RESULT: AFCO "ICDH" balls give you performance comparable with alloy balls – yet they cost no more than ordinary carbon balls. Sizes: ¾" to 5". Phone, write or wire NOW for quotations.

AMERICAN FORGE CO.

Executive offices and plant: Niles, California
Phone Niles 3311
Sales offices: 101 Park Ave., New York City; Portland, Oregon; Los Angeles, Calif.; Salt Lake City, Utah

"AFCO" PRODUCTS

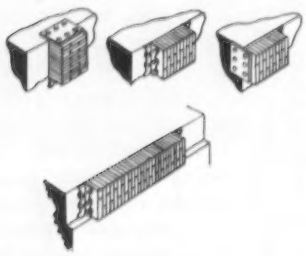


Versatile Lift Trucks Solve Many Materials Handling Problems

Oster Mfg. Co., Cleveland, Ohio, has a one-man propelled, 1000-lb capacity truck with battery-powered lift that extends to 112 in. high. Built-in charger operates off any 110v outlet. **(35)**

Model S-10 Moto-Bug by Kwik-Mix Co., Port Washington, Wis., now has hydraulically controlled tilting mast as option. Gasoline engine driven, 3-wheeled fork truck lifts 1,000 lb. **(36)**

Drum lift by Sterling, Fleischman Co., Broomall, Pa., raises 750 lb, 53 in. by foot-operated hydraulic jack. It can be used for pouring, stacking or rotating drums. Arms have holding brakes. **(37)**



Loading Dock Bumpers (38)

Made of reversible rubber-coated fabric, Flex-O loading dock bumpers are designed to minimize dock and truck damage. They are made in several sizes by Bumpers Inc., Cleveland, Ohio.

Platform Lift Truck (39)

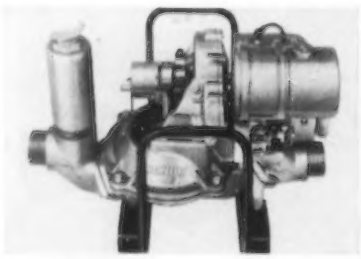
Low lift platform truck by Elwell-Parker Electric Co., Cleveland, Ohio, is claimed first to have operator seat. Battery or engine-electric units have four wheel steer and hydraulic lift.

Drum Handling Clamp (40)

Yale & Towne Mfg. Co., Philadelphia, Pa., has rotating drum handling attachment of 2,000-lb capacity for their lift trucks. One of rubber coated arms is flat so drums can roll off.

Helmet Liner (41)

Fleece lined twill "aviator style" headpiece worn under hard-hat beats low temperatures and is so modestly priced that it can be discarded when soiled, according to General Scientific Equipment Co., Philadelphia, Pa. Straps on top tie liner to helmet harness. Adjustable snap-on chin strap gives good fit and keeps helmet on.



Sand Pump (42)

Portable diaphragm pump 20DP3 by Homelite, Port Chester, N. Y., is designed for heavy duty pumping of mud and sand. Gasoline-engine powered unit weighs 120 lb and will handle 5,000 gph. Maximum head is 50 ft with high suction lift. It is supplied with 3-in. fittings but can be adapted to 2-in. hose. Speed is adjustable to fit job.

Safety Goggles (43)

Airflow flexible plastic eyeshields feature a nickeled 20 mesh ventilating screen around top and sides. Screen is molded into plastic frame and is said to give cool and fog-free protection. Made by U. S. Safety Service Co., Kansas City, Mo., it can be worn over prescription glasses. Replaceable lens tilts in toward face at bottom for better vision, it is said.

New Thor all-purpose one-man drilling machine

MODEL 390
DRILLING MACHINE
MOUNTED ON 72"
680 TELESCOPIC LEG

THOR introduces the powerful new 390 drilling machine with a host of features which speed up drilling operations and reduce operator fatigue.

This Thor drill is equipped with heavy-duty aluminum cylinder and chrome-plated steel piston rod and a specially designed 45 lb. sinker rock drill with integral feed leg connection. It can be easily converted for sinking. Thor 390 is equipped with a line oiler and automatic water valve which can be replaced with a plug for dry operation or collaring.

All controls are grouped on the backhead for safe convenient operation. A six position throttle, a Thor exclusive, gives a complete range of control from complete shut-off of air and water, to full air and water supply in logical steps for easy convenience and instant control.

Optional feed travel legs available in 36", 48" and the new model 680 72" telescopic leg.

Your nearest Thor representative will be glad to arrange for a demonstration. Thor Power Tool Co., Aurora, Ill.

Thor
PORTABLE POWER
TOOLS

New Thor 390—drifter, sinker, stoper—all in one

The Thor No. 390 is easily adaptable for all types of drilling at all angles. The drill can be removed from the leg for use as a sinker by loosening only one nut. Tool swivels into vertical position for stoping.

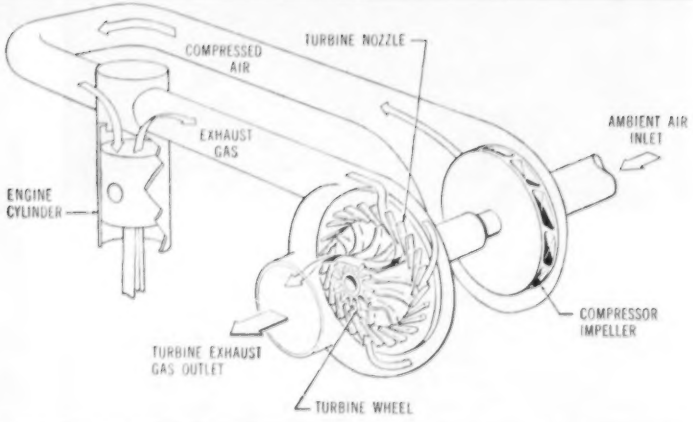
THOR POWER TOOL COMPANY

Atlanta	Chicago	Detroit	Newark	St. Louis	Export Division,
Birmingham	Cincinnati	Houston	Long Island City, N.Y.	San Francisco	New York City
Boston	Cleveland	Los Angeles	Philadelphia	Seattle	
Buffalo	Denver	Milwaukee	Pittsburgh	Toronto, Canada	

Caterpillar announces a TURBOCHARGED

D397 (SERIES D) 650 HP Maximum @ 1300 RPM AND D375 (SERIES D) 430 HP Maximum @ 1300 RPM

Compact, modern heavy-duty diesels for greater power, efficiency and economy!



The Cat D397 Turbocharged Engine

Both the D397 and the D375 are also available as *roots blown, naturally aspirated or spark ignited* engines.

The Turbocharger . . . Exhaust Gas and Air Flow

Another example of Caterpillar leadership in action! The Turbocharger, driven by the engine exhaust, utilizes energy which would otherwise be lost. It packs air into the engine according to engine *load* for greater efficiency.

As shown in the diagram above, engine exhaust gases turn the turbine, which drives the compressor . . . the compressed air then enters the cylinders. Final result: more power on less fuel.

More than eighteen years of research have gone into these two new CAT* Turbocharged Diesels. Incorporating metallurgical, mechanical and aerodynamic advances, they are engineered to deliver higher horsepowers and lower operating costs at reduced noise levels. Their advance-design features are also available in D397 and D375 Electric Sets and Marine Engines.

With these engines in the Caterpillar line-up, you now have an even wider choice of compact, modern heavy-duty power to meet your requirements. Get the complete facts about these two new Turbocharged Diesels from your Caterpillar Dealer!

Caterpillar Tractor Co., Peoria, Ill., U.S.A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

MODERN HEAVY-DUTY DIESELS

X-Ray Inspection Unit (44)

Designed for rapid inspection of structural members, pipe lines, welds et al., portable MG 260H X-ray radiography unit fits into trunk of car. It is made by North American Philips Co. Inc., Mt. Vernon, N. Y. and can operate from 110, 120 or 440 v ac power supply. It is waterproofed for outdoor use.

Masonry Coatings (46)

Magic-Vulc No. 266 vinyl coatings are claimed to completely waterproof cinder and concrete block, stucco and brick. Magic Chemical Co., Brockton, Mass., says they have excellent adhesion to all masonry surfaces and even old paint, will fill cracks and are easy to apply. Various colors are available.

All-Purpose Coating (45)

Everwear J-41-B paint is a bright ebony finish coating for protecting metal, wood or concrete. It is said to remain elastic during extreme temperature changes, to be chemical resistant and impervious to moisture. Quick drying and adaptable to brushing or spraying, it is made by Maintenance Inc., Wooster, Ohio.

Protective Coating (47)

Stontreet is a liquid pitch base bituminous resin for protecting macadam, concrete, asphalt or blacktop surfaces. On roofs it forms film which resists atmospheric fumes and smoke and water penetration; while on driveways it protects against gasoline, oil and chemicals, says Stonhard Co., Phila., Pa.

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

AIR COMPRESSOR selection is easy with handy slide rule available from Kellogg Div., American Brake Shoe Co., New York, N. Y. It gives displacement in cu ft, free air, and other data for single or two-stage compressors from ½ to 20 hp, at pressures from 50 to 200 psi. **(48)**

INDEX OF LITERATURE on products made by Allis-Chalmers Mfg. Co., Milwaukee, Wis., has been issued. The 4x9-in., 24-page booklet is also a handy directory of their products. **(49)**

SEMINARS on punched-card and electronic business systems and general management problems offered by Remington Rand, New York, N. Y., are outlined in brochure entitled "Invitation to Learning." **(50)**

URANIUM CONCENTRATION is featured in Deco Trefoil for January-February. Concise chart included, gives properties of uranium and thorium minerals. It is issued by Denver Equipment Co., of Denver, Colo. **(51)**

COPPER is subject of a series of articles being published in Copper & Brass Bulletin of Copper & Brass Research Assoc., New York, N. Y. First article in February issue is concise one on Classifying Copper and Its Alloys. **(52)**

WELDING alloy steel with mild steel electrode and alloy flux is briefly explained in 2-page bulletin from Lincoln Electric Co., Cleveland, Ohio. It deals primarily with automatic welding but gives some basic information. **(53)**

REPAIRING CAST IRON PARTS by welding with Ni-Rod electrodes is topic of 4-page booklet issued by International Nickel Co., Inc., New York, N. Y. Nine case histories are used to present latest information on method. **(54)**

CORROSION PROOFING materials and techniques for masonry is subject of brochure offered by Pennsylvania Salt Mfg. Co., Philadelphia, Pa. Eight-page, illustrated booklet details mortars, linings and coatings. **(55)**

MULTIPLE V-BELT DRIVE is discussed in 36-page booklet released by Allis-Chalmers Mfg. Co., Milwaukee, Wis. It is very complete text that tells how to engineer such a drive along with basic principles and practices and evolution. **(56)**

SURFACTANTS is the name given to a class of chemicals that can aid a wide variety of processes by altering the properties of surfaces. Foster D. Snell Inc., New York, N. Y., briefly describes their role in brochure. **(57)**

SYNTHETIC FLUIDS & LUBRICANTS of Carbide & Carbon Chemicals Co., Div. of Union Carbide & Carbon Co., New York, N. Y., are comprehensively covered in 52-page booklet. The Ucon brand compounds have unusual properties. **(58)**

LUBRICANTS for extremely severe service are specified in publication from Jet-Lube Inc., Burbank, Calif. Multi and special purpose oil and greases with various additives are discussed. **(59)**

ORIENTED DIAMOND BITS are cataloged by Sprague & Henwood, Scranton, Pa. All types of bits and reaming shells made using that technique are described. Advantages and

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8	22	36	50	64	78	92
9	23	37	51	65	79	93
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13	27	41	55	69	83	97
14	28	42	56	70	84	98

Name .....

Title .....

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Address .....

NEW PRODUCTS DIGEST *(Continued)*

story of development are given. **(60)**

INDUSTRIAL TRACTORS and accessory equipment of John Deere, Moline, Ill., are shown in booklet. Gasoline crawler, weighing slightly over 2 tons, and wheeled tractor, about 1½ tons, are featured. **(61)**

PORTABLE POWER TOOLS and accessories of Skil Corp., Chicago, Ill., are shown in catalog now available. Over 100 items ranging from saws through drills, sanders and grinders to polishers, are covered. **(62)**

MACHINE TOOLS and accessories of South Bend Lathe Works, South Bend, Ind., are presented in Golden Anniversary Catalog. Entire line of lathes, drill presses, shapers and grinders is shown, as well as new milling machine. **(63)**

HAND TOOLS for Sheet Metalwork, is title of catalog offered by Niagara Machine & Tool Works, Buffalo, N. Y. Nine new snips and shears are shown along with hammers, mallets, stakes, benders, crimpers, etc. **(64)**

PIPE NIPPLES by Pittsburgh Nipple Works Inc., Pittsburgh, Pa., come in a wide variety of composition, weights and sizes. Their catalog is claimed most complete in industry. Special types and shapes are available. **(65)**

FLUID POWER components—valves, cylinders and power units—are given in bulletin from Rivett Lathe & Grinder Inc., Boston, Mass. Complete standard line as well as custom built units are covered. **(66)**

LABORATORY EQUIPMENT utilizing heat—ovens, furnaces, water and oil baths, humidity cabinets and incubators—are covered in catalog published by Blue M Electric Co., Blue Island, Ill. They have wide application. **(67)**

PVC PIPE is a highly chemical resistant rigid material. Information on Ryertex-Omicron brand by Joseph T. Ryerson & Son Inc., Chicago, Ill., is given in bulletin. It can be handled much like metal pipe. **(68)**

PVC PIPE FITTINGS available from Grinnel Co., Inc., Providence, R. I., are specified in catalog. Engineering data based on latest tests and field experience cover applications as well as strength, sizes, etc. **(69)**

PIPE & BLOCK INSULATION made of Thermobestos compound by Johns-Manville, New York, N. Y., is described and cataloged in booklet just released. It can be prefabricated in many shapes for snug fit. **(70)**

ALLOY STEEL T-1 is readily welded and designed to combine toughness with very high strength. Engineering data and fabrication recommendations are given in bulletin from Lukens Steel Co., Coatesville, Pa. **(71)**

HOISTS made by King Manufacturing Corp., Chicago, Ill., are shown in brochure. The hydraulically controlled units are furnished with or without gasoline or electric power units, in single or double drum models up to 34 hp. **(72)**

SCALPING SCREEN bulletin by Allis-Chalmers Mfg. Co., Milwaukee, Wis., describes Model XXH, a vibrating screen designed to handle run-of-mine ore in pieces up to 4 tons without shock to bearings. **(73)**

PUMPS for medium and high head service are described and illustrated in bulletin from C. H. Wheeler Mfg. Co., Philadelphia, Pa. Called Wheeler-Economy Type M, the centrifugal pumps come in bottom or side suction models. **(74)**

CENTRIFUGAL FANS designed to fill any requirement for Class I or II types are described in illustrated bulletin by Chicago Blower Corp., Franklin Park, Ill. Called Chicago line, they are recommended for hot gases. **(75)**

AFTERCOOLER, called Niagara Aero, is treated in brochure from Niagara Blower Co., New York, N. Y. Text and diagrams explain functions in removing moisture from compressed air or gas. Photos show applications. **(76)**

CRANE & EXCAVATOR, CR-35, made by Schield Bantam Co., Waverly, Iowa, is ⅜-cu yd, 6-ton model described in new bulletin. Self-propelled, wheeled unit has no-shift forward-reverse travel feature. **(77)**

CRANE & EXCAVATOR, called RailAid, by Koehring Co., Milwaukee, Wis., is crawler mounted, can lift 7 to 9 tons working on or off its own rail car, and is self-propelled when on rails or ground. Bulletin is offered by company. **(78)**

CRANE & EXCAVATOR offered by Thew Shovel Co., Lorain, Ohio, as Lorain Moto-Crane, Model MC-425 or 425W, is covered in bulletin. Mounting for turntable of wheeled unit is termed revolutionary. **(79)**

SPEED REDUCERS offered under trade name of Torque-Arm by Dodge Mfg. Corp., Mishawaka, Ind., are detailed in bulletin. Being shaft-mounted, units need no foundation and have capacities from 1 to 60 hp. **(80)**

CONDENSATE & VACUUM PUMP bulletin is available from Sarco Co. Inc., New York, N. Y. Catalog gives engineering data in considerable detail. Their latest condensate pump, Type S, is featured. **(81)**

EARTH MOVING in four ways with Drott Four-In-One skid shovel is described in two folders from International Harvester Co., Chicago, Ill. Flick of hydraulic lever converts front-end tractor loader to bulldozer, clamshell or scraper-like bullclam. **(82)**

LIGHT IT...and Beat it!

IGNITACORD® will ignite every fuse in the round

TYPICAL HOOKUPS

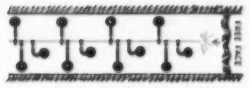
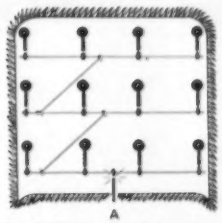


Fig. 1 shows a stope drilled with three rows of uppers, the fuse from each hole being connected to a single line of Ignitacord. Note that the center holes will fire before the two corresponding rib holes.



In *Fig. 2* the fuses extending from the horizontal breast holes are connected to four lines of Ignitacord at regularly spaced intervals. Jumper lines connect the horizontal lines, and the igniter cord is activated by a length of Safety Fuse at Point A.

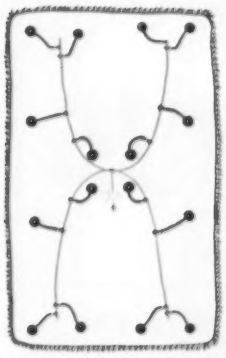
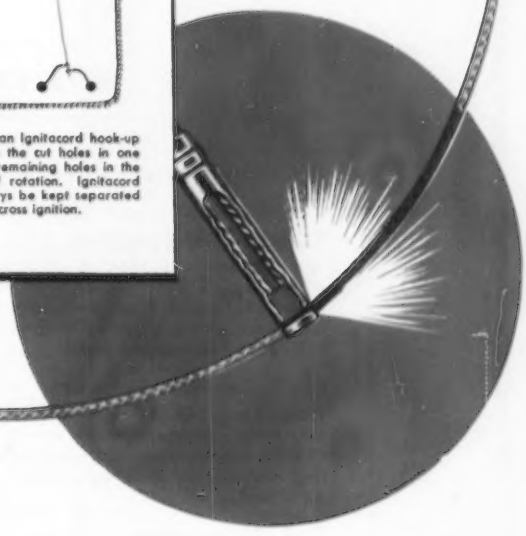


Fig. 3 illustrates an Ignitacord hook-up arranged to fire the cut holes in one group, and the remaining holes in the proper order of rotation. Ignitacord lines should always be kept separated enough to avoid cross ignition.



Blasting rounds, primed with cap and fuse, can be fired in any planned rotation – safely and easily – by connecting all fuse with Ensign-Bickford Ignitacord*. This flexible cord, ignited from an open flame, burns progressively along its length, producing a short, *hot* external flare at the zone of burning.

Time delay to obtain desired rotation of the round is accomplished by the spacing of the Connectors along the Ignitacord; the cord is color-marked at one-foot intervals. All fuses in the round must be the same length. An Ignitacord Connector is crimped onto the open end of the fuse before loading and the Ignitacord is inserted into a slot in the Connector and the top flap is pressed down firmly to hold it securely in place. Ignitacord: Type A (green cord) burns 8 to 10 seconds per foot; Type B (red cord) burns 16 to 20 seconds per foot. 100 feet per spool. Connectors are supplied in packages of 100.

See your Explosives Supplier or write to

THE ENSIGN-BICKFORD COMPANY

SIMSBURY, CONNECTICUT

Manufacturers of PRIMACORD® Detonating Fuse – and Safety Fuse since 1836

IG-4

*Sold on the West Coast under the name of SPITTERCORD by the Coast Manufacturing Supply Co., Livermore, California.

CF&I STEEL PRODUCING PLANTS

CF&I Pueblo, Colorado

Blast Furnaces and Open Hearths producing pig iron, ingots, blooms, billets and rods.

CF&I Buffalo, New York

Blast Furnaces and Open Hearths producing pig iron, ingots, blooms, billets and rods.

CF&I Claymont, Delaware

Open Hearths producing ingots and steel plate.

CF&I Roebling, New Jersey

Open Hearths producing ingots, blooms, billets, and rods.

CF&I Brooke, Pennsylvania

Blast Furnaces producing basic, Bessemer, foundry, malleable and low phosphorus pig iron.

QUALITY IS AN "EVERY-

CF&I FABRICATING PLANTS

The quality of CF&I steel products is firmly controlled since the requirements of each product determine the analysis of the steel.

CF&I Buffalo, New York

Fine and Specialty Wire of all types including Manufacturer's Wire (Basic, Spheroidized, Annealed, Tempered, Bright and Liquor Finish, Low and High Carbon)—Welded Wire Fabric—Chain Link Fence—Galvanized Strand.

CF&I Claymont, Delaware

Flanged and Dished Heads—Carbon and Alloy Steel Plates—Stainless-Clad Plates—Nickel Lectro-Clad Plates—Manhole Fittings and Covers—Large Diameter Welded Steel Pipe—Flame Cut Steel Plate Shapes.

CF&I Clinton, Mass.

Poultry Netting—Hex Mesh Nettings—Hardware Cloth—Industrial Wire Cloth—Alloy Processing Belts—Perforated Metals—Overhead Conveying Equipment—Sliding Door (Industrial) Hardware.

CF&I Mt. Wolf, Pennsylvania

Insect Wire Screening and Industrial Wire Cloth.

CF&I Oakland, Calif.

Fish and Crab Trap Netting—Stucco Netting—Poultry Netting—Hardware Cloth—Industrial Wire Cloth—Straightened and Cut Wire—Reinforcing Tie Wire—Mechanic's Wire—Chain Link Fence—Crimped Wire.

CF&I Palmer, Mass.

Wire Rope—Wire Rope Slings—Wire, all types (see Buffalo Plant)—Wire Clothesline—TV Guy Wire—Aircraft Control Cable.

CF&I Pueblo, Colo.

Bar, Rod and Structural Products—Grader Blades and Cutting Edges—Rails and Accessories—Chain Link Fence—Woven Wire Fence—Fence Stays—Fence Posts—Corn Cribs—Welded Wire Fabric—Nettings—Grinding Balls and Rods—Screen and Grizzly Bars—Rock Bolts—Galvanized Strand—Clothesline—Barbed Wire—Manufacturer's Wire (Basic, Chain, Spring, Stapling, Weaving, Welding)—Merchant Wire (Annealed and Galvanized)—Nails—Bolts—Nuts—Spikes—Seamless Casing and Tubing.

CF&I Roebling, N. J.

High Carbon Steel Wire (Hard Drawn, Spheroidized and Tempered)—Rope Wire—Tire Bead—Hose Wire—ACSR Core Wire—High Carbon Spring Steel Wire (All grades, tempers and finishes)—Regulator, Sash Balance and Flapper Valve Wire.

CF&I Roebling (Trenton), N. J.

High and Low Carbon Flat Wire (All tempers, edges and finishes)—Brush, Corset, Casing, Heddle and Drop Wire, Umbrella Wire and Tape Lines—Wire Rope—Strand, Aircord and Fittings—Wire Rope Slings—Electrical Wire and Cable and Magnet Wire.

CF&I So. San Francisco, Calif.

Galvanized and Annealed Merchant Wire—Galvanized and Annealed Stone Wire—Bale Ties—Baling Wire—High and Low Carbon Wire—Galvanized and Annealed Wire—Copper Coated Wire—Rope Wire—Welding Wire.

CF&I Worcester, Mass.

Valve and Clutch Springs—Starter Springs—Tire Chain Adjusters—Cross Chain Repair Links—Mechanic's Wire—Compression, Extension and Torsion Springs of all types—Formed Wires.

STEP" OPERATION

at CF&I

THE COLORADO FUEL AND IRON CORPORATION

DENVER • OAKLAND • NEW YORK

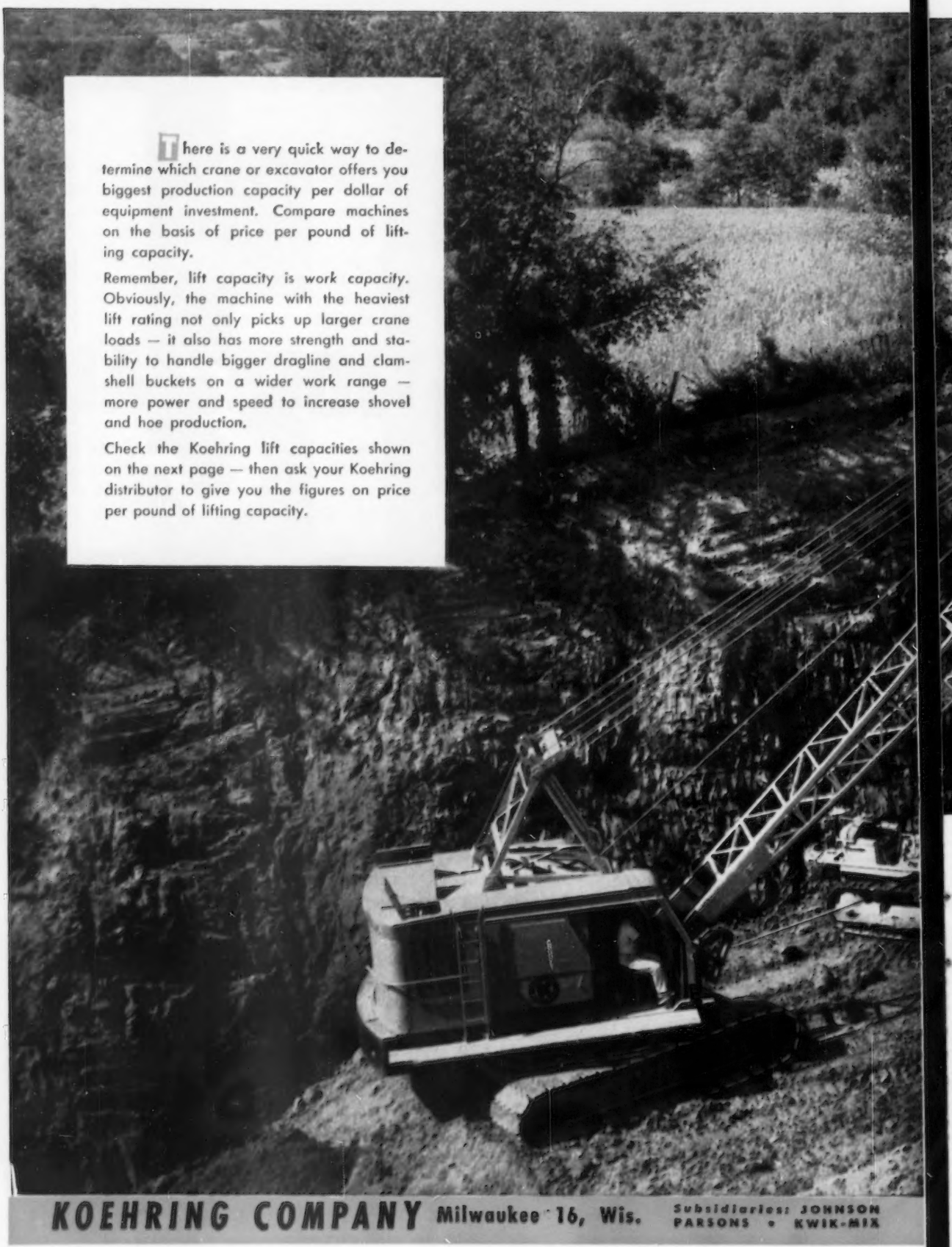
There's only one positive way to make sure that steel products will give long-lived, trouble-free service. That's to start with a system of rigid quality controls even before the iron ore goes into the blast furnace—and constantly maintain these controls throughout every stage of production until the product is shipped.

This is the policy at CF&I. Quality control is an "every-step" operation which is part of the job at every CF&I plant.

What's more, CF&I offers you another important advantage—a widely-diversified line of steel products from one source which enables you to get the exact size and type of product that's best for your particular job.

Next time you're in the market for steel or steel products, it'll pay you to contact CF&I.

3490

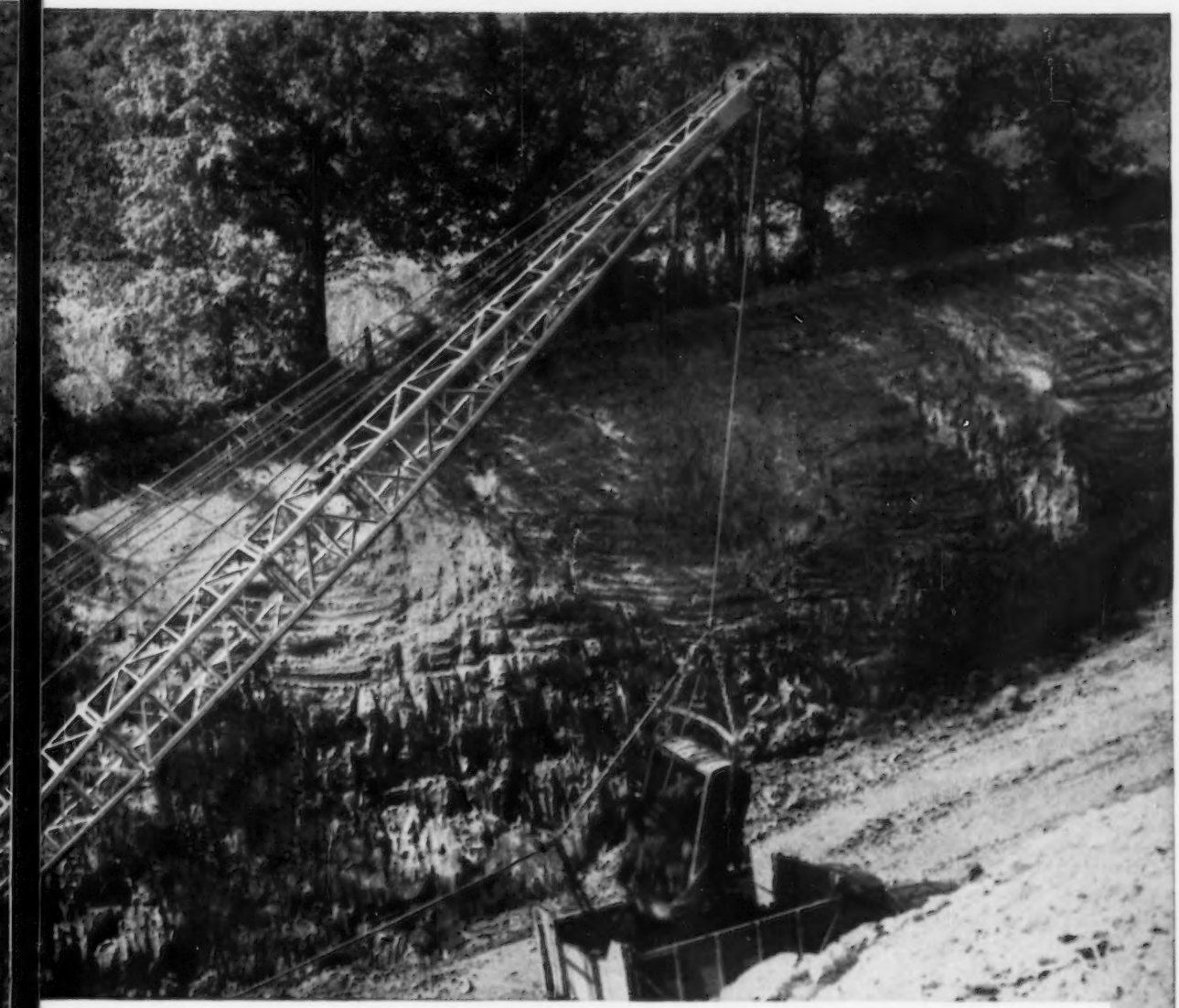


There is a very quick way to determine which crane or excavator offers you biggest production capacity per dollar of equipment investment. Compare machines on the basis of price per pound of lifting capacity.

Remember, lift capacity is *work capacity*. Obviously, the machine with the heaviest lift rating not only picks up larger crane loads — it also has more strength and stability to handle bigger dragline and clamshell buckets on a wider work range — more power and speed to increase shovel and hoe production.

Check the Koehring lift capacities shown on the next page — then ask your Koehring distributor to give you the figures on price per pound of lifting capacity.

KOEHRING COMPANY Milwaukee 16, Wis. Subsidiaries: JOHNSON PARSONS • KWIK-MIX



Check price per pound of lifting capacity

KOEHRING MODEL	SIZE DIPPER	KOEHRING LIFT CAPACITIES (Crawler ratings based on 75% of tipping load. Rubber-tired machines — 85% of tipping load)		PRICE PER POUND OF LIFT CAPACITY*
205 CRAWLER	½-Yd.	20,000 lbs.	30-foot boom at 10-ft. radius	?
205 ON RUBBER	½-Yd.	30,000 lbs.	25-foot boom at 12-ft. radius	?
304 CRAWLER	¾-Yd.	27,800 lbs.	35-foot boom at 12-ft. radius	?
304 ON RUBBER	¾-Yd.	50,000 lbs.	30-foot boom at 10-ft. radius	?
405 CRAWLER	1-Yd.	40,000 lbs.	40-foot boom at 12-ft. radius	?
605 CRAWLER	1½-Yds.	72,300 lbs.	50-foot boom at 12-ft. radius	?
1005 CRAWLER	2½-Yds.	159,000 lbs.	50-foot boom at 12-ft. radius	?

KOEHRING HEAVY DUTY

***Figures available on request—ask your Koehring distributor for them.**

Lined with Lorain . . . for millions of tons at Universal Atlas' Northampton Plant

In 1943, when Universal Atlas opened its modern Northampton, Pa., plant, thirteen of the grinding mills were lined with USS Lorain rolled steel plate mill liners, and three of these mills still have the original liners. At Northampton experience has shown that no cast liner can withstand the tumbling of heavy media—4-inch grinding balls are used in wet primary grinding of raw material and in the primary clinker mills—like this tough, rolled and hardened steel lining.

In one of Northampton's 9′ 6″ primary, wet raw mills, a Lorain lining ground 1,932,548 tons of rock. A second Lorain lining in this mill ground out 1,858,595 tons. The present lining, installed last year, is a new type—a Lorain lining designed for the heaviest duty. Careful measurements of the wear so far and the plant's experience with this particular type liner in other mills indicate a conservative 2¼ million ton life and a lining cost, including labor, of only $2.71 per thousand tons ground.

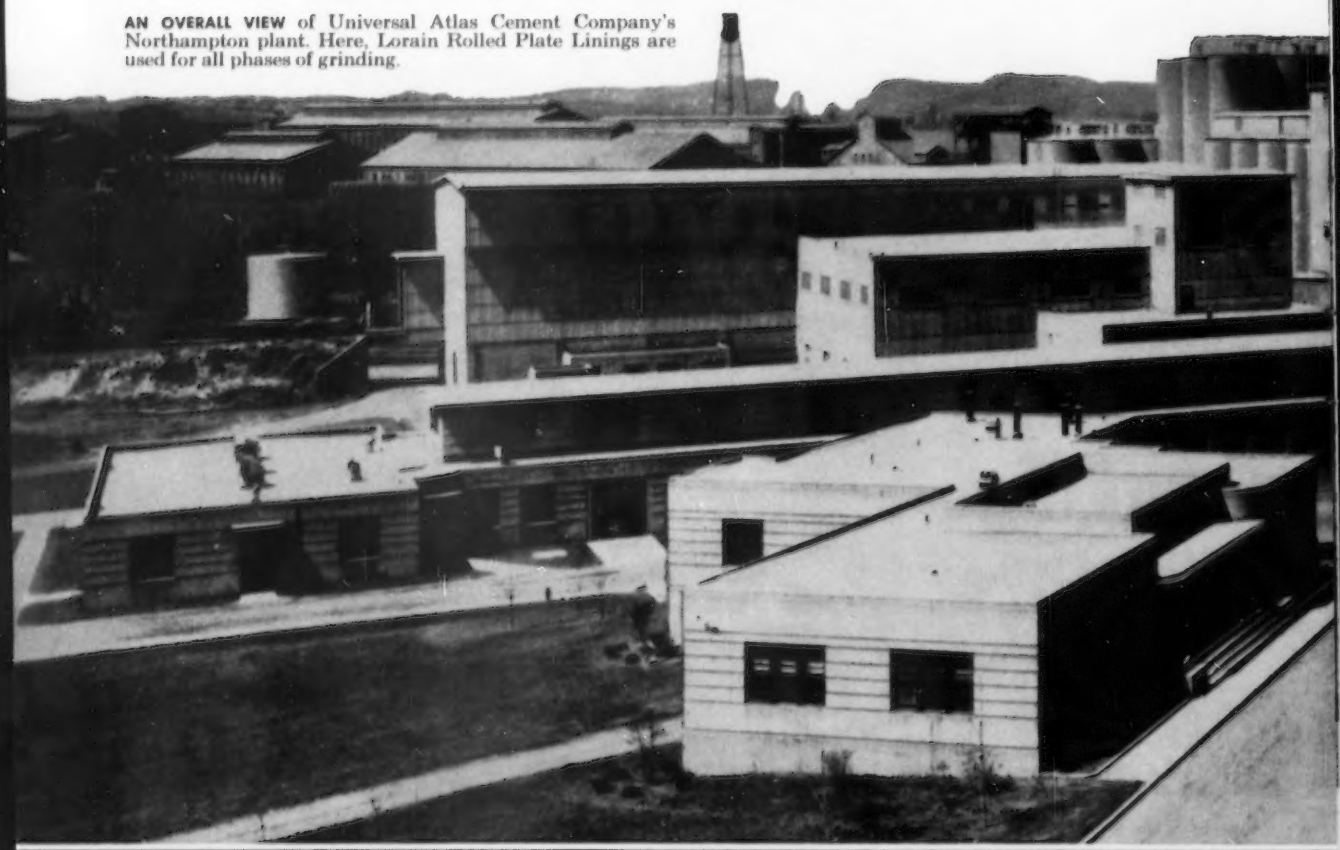
USS Lorain linings give bonus-life service because they are made of tough, rolled steel—uniformly hot-worked and free of blow-holes or inclusions that are a frequent cause of breakage in castings. The lift bars are of heat treated alloy steel, hardened to resist abrasion and impact and to provide efficient lift even when the plates are worn to paper thinness. Every Lorain lining is designed to fit its mill precisely with a maximum of contact between lining and shell for good support. No backing or zincing is required.

If you are in need of expert technical assistance on any grinding problem, write: Specialty Products Sales, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

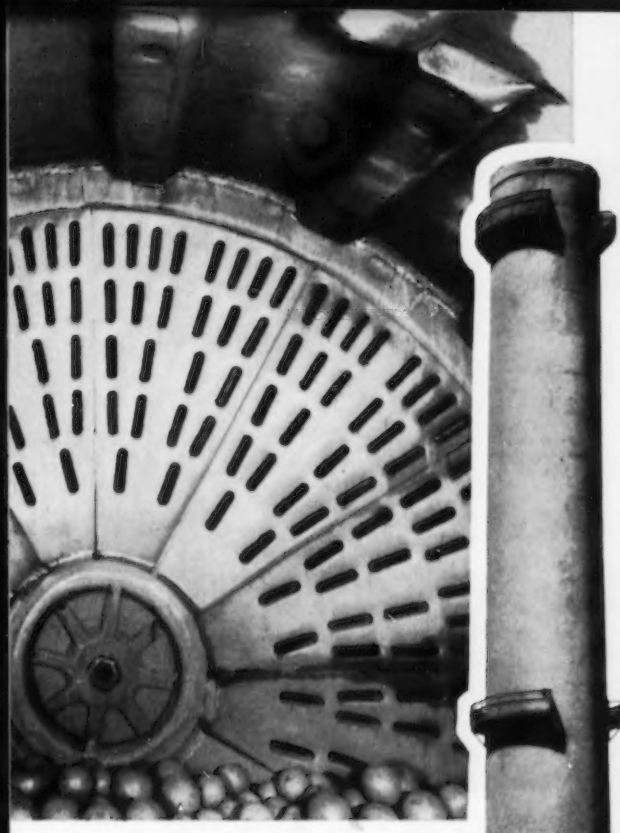
UNITED STATES STEEL CORPORATION, PITTSBURGH · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS LORAIN ROLLED PLATE LININGS *and* USS GRINDING BALLS

AN OVERALL VIEW of Universal Atlas Cement Company's Northampton plant. Here, Lorain Rolled Plate Linings are used for all phases of grinding.

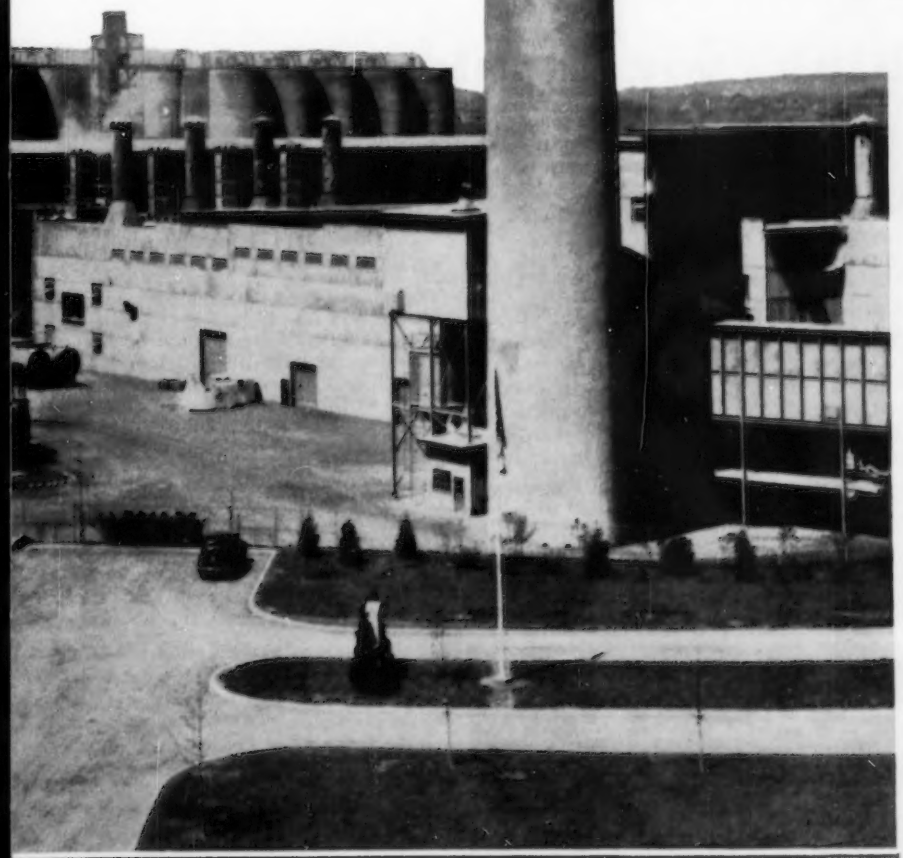


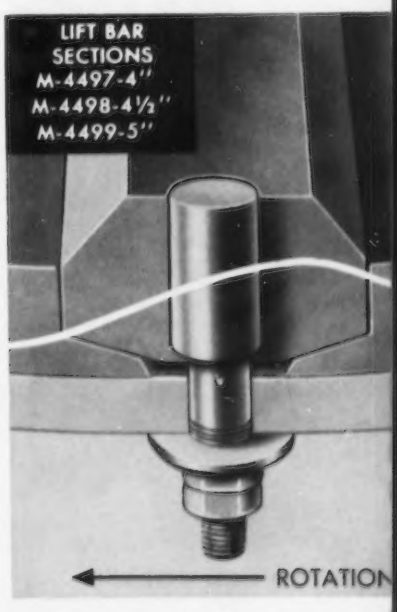
UNITED STATES



INTERIOR VIEW FACING DISCHARGE END of a 9′ 6″ secondary ball mill (wet process) at Universal Atlas' Northampton, Pa., plant. At time picture was taken this Lorain liner had ground 496,815 tons.

THIS IS AN INTERIOR VIEW OF THE FEED END of one of the grey clinker primary mills. 4-inch Lorain Grinding balls are used as make-up throughout. This lining has ground 1,836,688 barrels of clinker to date. As can be seen from the condition of the lining, wear is estimated to be under 20 per cent; several million more barrels will be ground before replacement is necessary.

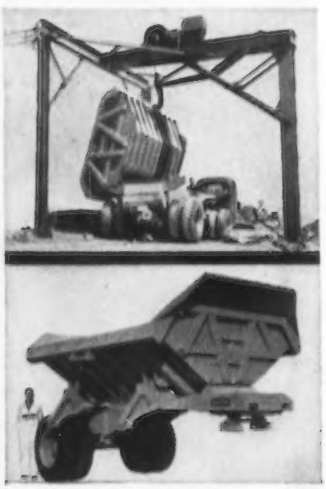




THIS CROSS-SECTION drawing shows the heavy-duty type USS Lorain Lining used in primary grinding. This type lining has ground millions of tons of grey rock at Northampton at a liner cost—including labor—of $2.71 per thousand tons. White line on drawing indicates maximum wear profile.

The following notes are quoted by permission from an actual letter written by one quarry operator to another...

My boss thinks you should read this...



YOU CAN'T BEAT THIS COMBINATION

...exclusive EASTON electric overhead dumping system and EASTON doorless pan trailer. EASTON trailer capacities range from 10 to 36 tons. For exceptional grades the EASTON pan body may be truck-mounted.

MY BOSS *is a very fair man. He has end dump trucks and side dump trailers and uses both on jobs for which they are suited. But, when another quarry man asked us what we find best for* straight quarry work, *here's what my boss dictated:*

"BOTH TYPES of trucks are required to meet our operational requirements. Were ours a straight quarrying operation, we undoubtedly would favor the side dump trailer units for the following reasons:

"1—Side dump trailer units carry greater pay loads using the same truck as a tractor that is used with the end dump bodies (side dump unit capacity, 35 tons,—end dump unit capacity, 22 tons).

"2—Less spillage experienced hauling 35 tons with side dump units than 22 tons with end dump units (attributed to backs on the side dump trailer units).

"3—Shovel operators claim that loading the side dump units is easier.

"4—Though our roads are maintained for the very best of haulage conditions, racking of loads could be a problem, and in this instance longer unit chassis life should be experienced in the trailer type haulage unit through the better load distribution and the trailer universal action at the tractor hitch.

"5—Dumping at the crusher takes about the same time for both units. The side dump units are dumped by a push-button controlled electric overhead hoist, operated by an attendant at the crusher."

EASTON®

EASTON CAR & CONSTRUCTION COMPANY • EASTON, PA.

A good haulage system must provide efficient dumping. For the most efficient system you can own get the advantages of EASTON's exclusive background of experience and the EASTON automatic electric overhead hoist. B-1071

CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

AEROFROTH® 65 *Frother Improves Gold Flotation*

This recent report from a Cyanamid Field Engineer tells how AEROFROTH 65 Frother is used to improve overall gold recovery at a Mexican gold-copper operation:

"This plant treats approximately 500 metric tons a day of complex copper ore occurring with gold and pyrite in quartz and calcite. A copper concentrate is produced by flotation with AEROFLOAT® 208 Promoter at 0.1 lb. per ton. Metallic gold is recovered from the copper concentrates, as well as the flotation tailings, through the use of blankets. Before switching to AEROFROTH 65 Frother a combination of cresylic acid and AEROFROTH 70 Frother was used at the rate of 0.5 lb. per ton of ore milled. Present consumption of AEROFROTH 65 Frother is only 0.005 lb. per ton, viz:

Period	Frother	Consumption lb./ton	% Au Recovery
Previous 5-month	cresylic—F70	0.5	72.10
Last month	AEROFROTH 65 Frother	0.005	77.44

"With AEROFROTH 65 Frother in a high-lime circuit at pH 11.2 to 11.5, the gold appears to be more floatable than with other frothers. Since payment for gold in the copper is the same as for gold as bullion, the operators are very pleased with the increased recovery by flotation and the reagent costs".

A Cyanamid Field Engineer will be glad to work with you in your mill to increase recovery through an improved reagent set up. Merely write or phone our nearest office.

AMERICAN CYANAMID COMPANY

MINERAL DRESSING DEPARTMENT

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Cable Address – Limenitro, New York

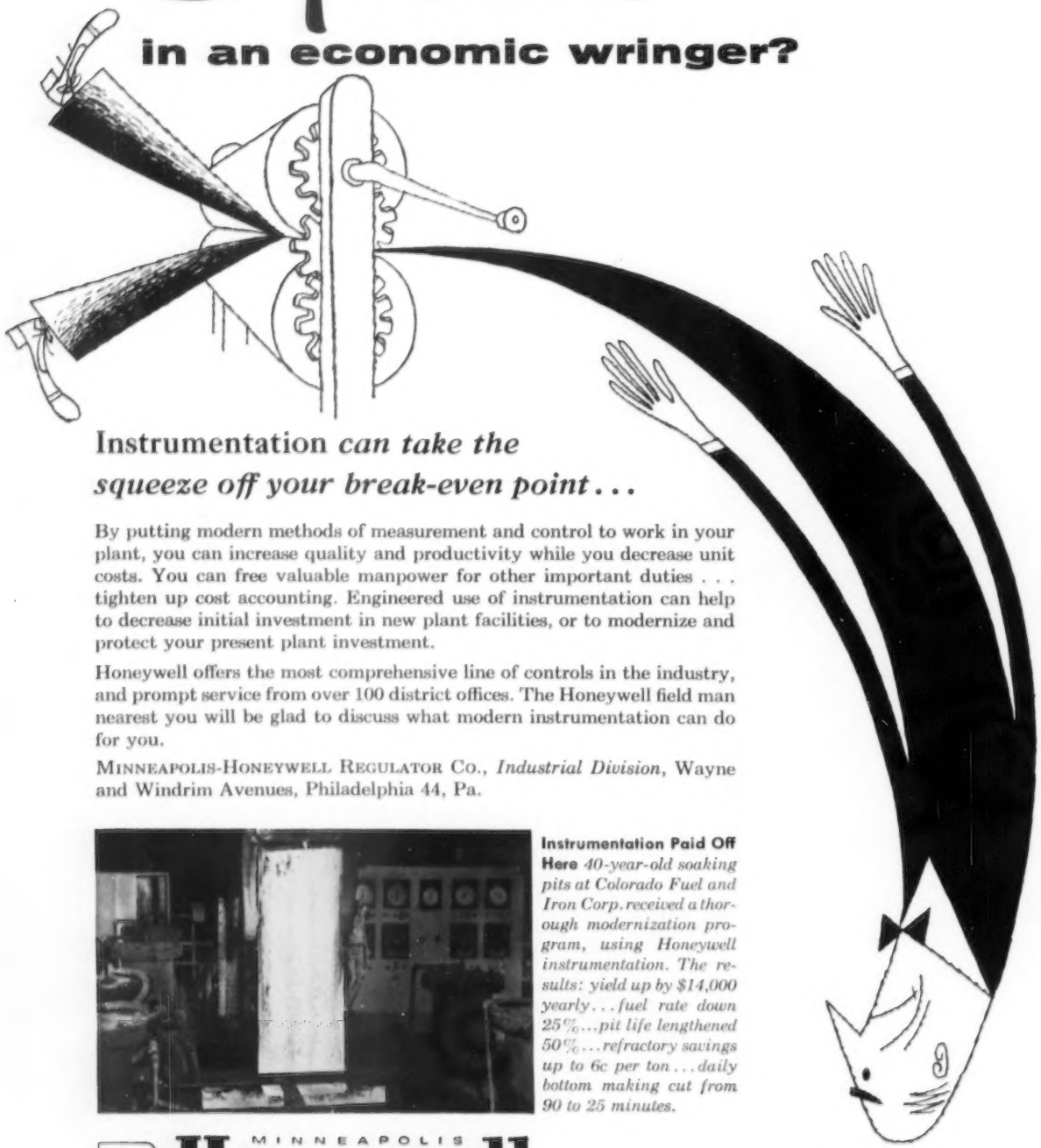
NORTH AMERICAN CYANAMID LIMITED
Royal Bank Bldg., Toronto 1, Ontario, Canada
CYNAMID DE MEXICO, S. A.
Apartado No. 26012, Mexico 12, D. F., Mexico

CYANAMID PRODUCTS, LTD., Bush House,
Aldwych, London W. C. 2, England
SOUTH AFRICAN CYANAMID (PTY.) LTD.,
P. O. Box 7552, Johannesburg, Union of South Africa

E. P. CADWELL, Belen 1043,
Of. 6, Lima, Peru
G. B. O'MALLEY, MALCOLM GLEN,
377 Little Collins St., Melbourne C. 1, Australia

Squeezed

in an economic wringer?



Instrumentation *can take the squeeze off your break-even point . . .*

By putting modern methods of measurement and control to work in your plant, you can increase quality and productivity while you decrease unit costs. You can free valuable manpower for other important duties . . . tighten up cost accounting. Engineered use of instrumentation can help to decrease initial investment in new plant facilities, or to modernize and protect your present plant investment.

Honeywell offers the most comprehensive line of controls in the industry, and prompt service from over 100 district offices. The Honeywell field man nearest you will be glad to discuss what modern instrumentation can do for you.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Instrumentation Paid Off Here *40-year-old soaking pits at Colorado Fuel and Iron Corp. received a thorough modernization program, using Honeywell instrumentation. The results: yield up by $14,000 yearly . . . fuel rate down 25% . . . pit life lengthened 50% . . . refractory savings up to 6c per ton . . . daily bottom making cut from 90 to 25 minutes.*

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

Write for a copy of Honeywell's Automation Dictionary

CYNAMID DE MEXICO, S. A.
Apartado No. 26012, Mexico 12, D. F., Mexico

SOUTH AFRICAN CYANAMID (PTY.) LTD.,
P. O. Box 7552, Johannesburg, Union of South Africa

G. B. O'MALLEY, MALCOLM GLEN,
377 Little Collins St., Melbourne C. 1, Australia

FIGURE PROFIT HERE, TOO WITH Yellow Strand FLATTENED STRAND WIRE ROPE

You count on track-type tractors, shovels and other equipment for profits. But what about wire rope? You can also figure higher profits by using longer life, more serviceable wire rope.

Yellow Strand Flattened Strand is formed of high quality strands laid up in triangular form (see below) which give you greater contact area that spreads the load over more of the surface. This reduces wear and gives your rope longer life. You get 10% greater strength; you get a wire rope that many owners report lasts up to twice as long as ordinary rope and significantly reduces wear on sheaves and drums. And because it lasts longer, Yellow Strand Flattened Strand saves you much of the time and money lost in frequent rope changes.

So, get Yellow Strand Flattened Strand for longer life, and increased profits. See your Broderick & Bascom Distributor.

COMPARE *Yellow Strand* FLATTENED STRAND

with ordinary (at right) wire rope. In Flattened Strand you have twelve contact points, greater contact area, smoother surface, less wear.

Yellow Strand®
Manufacturers of Wire Rope for 80 Years

Broderick & Bascom Rope Co.
4203 Union Blvd., St. Louis 15, Mo.

American Logging Tool Corporation is a subsidiary of Broderick & Bascom Rope Co.

Firestone NYLON TIRES

CUT DOWNTIME LOSSES AND REDUCE TIRE COSTS ON LARGE OR SMALL HIGHWAY CONSTRUCTION JOBS

TODAY's fast highway construction timetables call for rugged, efficient earth moving equipment that is capable of top performance in all types of soil conditions.

Earth moving units, like the one illustrated above, will maintain better schedules and cost less to operate if they roll on Firestone Nylon Tires.

Firestone Nylon Tires are built for the toughest service. The treads give maximum traction and they are extra tough to resist cutting. Double-thick sidewalls give added protection against cuts and snags.

Firestone's Safety-Tensioned Gum-Dipped nylon cord body gives greatest protection against impact breaks . . . flex breaks . . . heat failures . . . and water damage.

Let your Firestone Dealer or Store show you how Firestone Nylon Tires will cut downtime and increase the profits on any job.

A TIRE FOR EVERY ROAD, LOAD AND CONDITION OF SERVICE

GROUND GRIP GG WIDE BASE ROCK GRIP RG WIDE BASE ALL NON-SKID ALL TRACTION RIB EXCAVATOR

WHEN YOU BUY NEW EQUIPMENT OR REPLACEMENT TIRES, SPECIFY FIRESTONE

Enjoy the Voice of Firestone on radio or television every Monday evening over ABC

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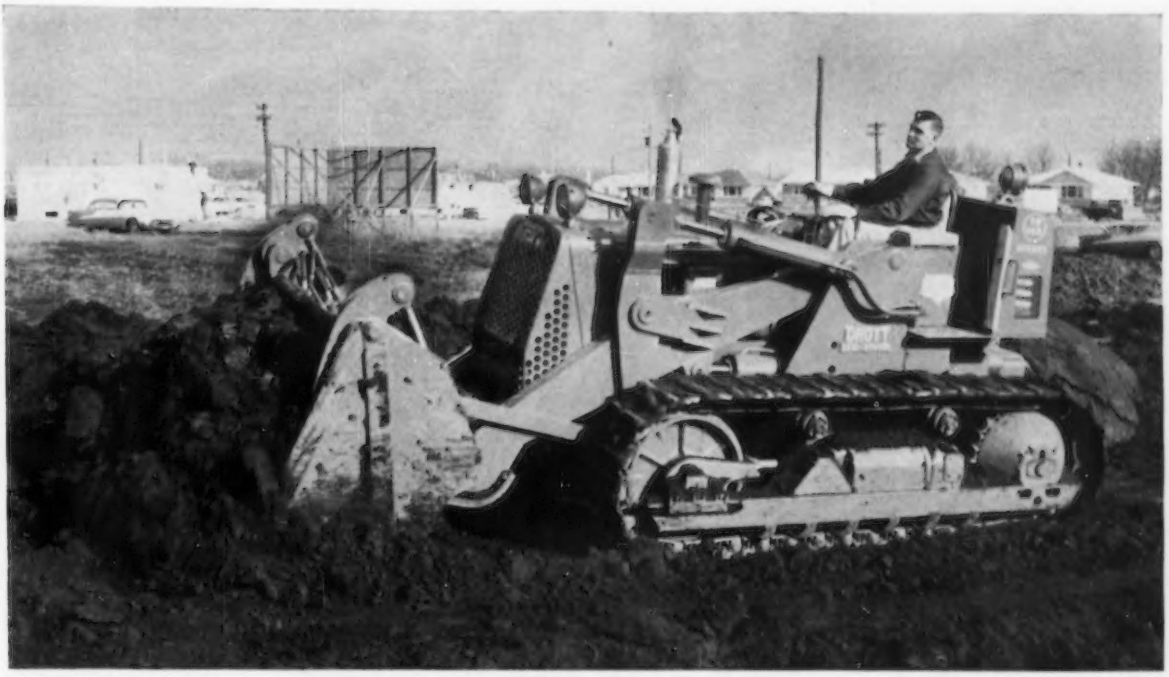


It's Skid-Shovel, dozer, clamshell and "carry-type scraper," all in one

...It's the International Drott 4-In-1!

Skid-Shovel position gives you a speedy, straight-forward, depth-controlled bucket-fill. And to get "concrete-smashing" excavating force, just apply exclusive Drott *triple-power, pry-action breakout!* . . . Give the "machine selector" lever a finger-tip flick, for big-capacity dozing under hydraulic control . . . Another flick gives you a gravel-gulping clamshell, with a 30-inch dumping height advantage over ordinary "roll-forward" buckets! . . . Another lever-flick, and Bull-clam action is at your service—to heap-load the bucket like a carry-type scraper; to strip, grade, or spread with amazing accuracy, using clam lip control! And you *select* any Four-In-One machine action *on the go!*

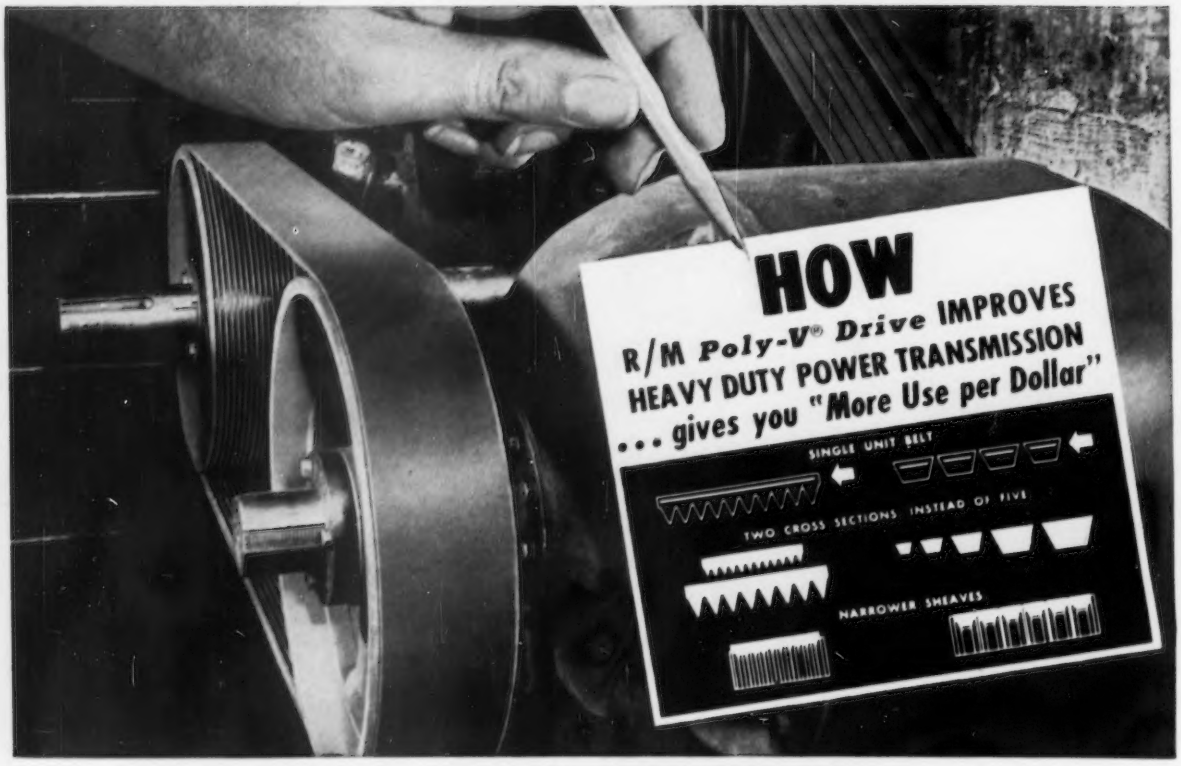
It's the exclusive International Drott Four-In-One that arms you to beat a fleet of limited-duty rigs. Now available in 3 sizes, 1-yard to 2¼-yard capacity—all with the built-in protection of exclusive, shock-swallowing Hydro-Spring! Ask your International Drott Distributor for a Four-In-One *versatility unlimited* demonstration!

Ditch, grade, "dress shoulders" with Bullangledozer Attachment!

Remove bucket and attach this low-priced Bullangledozer—angle the blade to either side—then tilt the blade from the seat as desired with Drott's exclusive, roll-back action—and you've got a real ditching, sloping, or shoulder-dressing outfit. Or used as a straight dozer, this blade does heavy digging or fine grading under hydraulic "radius control." *Give it a try-out!*

International Harvester Company, Chicago 1, Illinois

INTERNATIONAL® DROTT



R/M *Poly-V® Drive*

"Trouble-Proofs" this Mine Fan Drive!

Less shaft overhang . . . *less* drive weight . . . *less* bearing load! The exclusive features of patented R/M Poly-V* Drive eliminated the primary causes of belt failure on the mine fan drive pictured above. Overheated bearings —even a broken jack shaft—threatened the supply of vital fresh air to an underground mine until engineers replaced the former drive with a new R/M Poly-V Drive with its space-saving, lighter weight. It's a new concept in heavy duty power transmission.

Unique design reduces the width of Poly-V Drive to only two-thirds to three-quarters that of standard multiple V-belt drives of the same capacity. That's because Poly-V Drive employs a single, endless parallel V-ribbed belt running on sheaves grooved to mate precisely with the belt ribs. Uniform pull of this single unit belt distributes drive load evenly over the entire width of the sheave . . . gives higher horsepower capacity per inch of drive width. No other belt drive can deliver as much power in as little space!

Poly-V Drive's "single unit" belt design also eliminates stretching and V-belt "matching" problems. Uniform power delivery and drive dependability is *not* limited to individual V-belt life. Speed ratio is constant. Costly belt and sheave inventories are reduced to a new low because just *two* cross sections of Poly-V meet every heavy duty power requirement.

R/M engineers are ready to help *you* improve your belted drives . . . get "More Use per Dollar" . . . with R/M Poly-V Drive. Contact R/M . . . or write for a copy of Poly-V Drive Bulletin #6638.

CONDOR V-BELTS • R/M SUPER-POWER V-BELTS

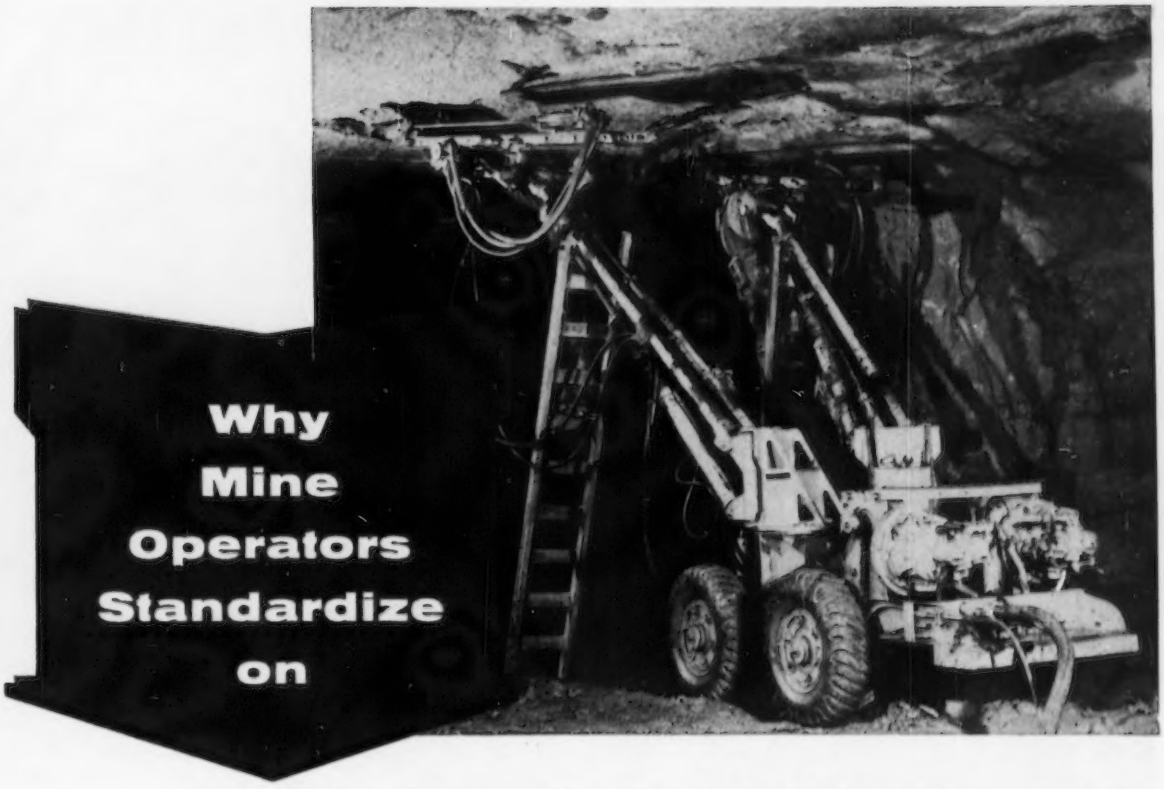
Write for Bulletin #6868 on the complete line of Condor V-Belts for regular service on conventional V-belt drives. Also write for Bulletin #6628 on R/M Super-Power V-Belts with 40% more Horsepower capacity where needed.

*Poly-V is a registered Raybestos-Manhattan trademark. RM-607

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Laundry Pads and Covers • Bowling Balls



Why Mine Operators Standardize on JOY DRILLMOBILES

In 1952, an underground copper mine operator purchased two Joy rubber-tired, self-propelled Drillmobiles and two crawler-mounted jumbos of another make. Since then, this operator has standardized with the purchase of 20 additional Joy Drillmobiles. Here's why—

MOBILITY—To get high production in low-grade copper ore, this operator needed extremely mobile, highly maneuverable equipment. He got it in the fast-tramming Joy Drillmobile with tractor-type steering that makes it possible to turn around within its own length, to get into the tightest drilling locations and around short curves.

VERSATILITY—Drilling 32′ wide drifts in a highly faulted ore body, where room height at times gets down to six feet, was no problem for the Joy Drillmobile. Mounting two extensible Hydro Drill Jibs with 12′ long chain feeds, it was low enough to get into the lowest drifts and yet could drill horizontal holes at a height of 18′. The wide-spreading jibs permitted drilling the wide drifts from one set-up.

FASTER DRILLING—Air-hydraulic controls on the Joy Drillmobiles, featuring power-lift and power-swing, gave fast easy drill positioning. Drilling speed of the Joy T-350 Drifters mounted on the jibs was 16% faster than the drills on the other machines.

LOW UPKEEP COSTS—Maintenance costs for the Drillmobile including the Joy Drifters, at 1½ cents per ton, were considerably lower than the cost for the other machine and drifters.

• • •

The versatility of the Joy Drillmobile and the variety of models available makes it applicable to your mining plan. Write for more information today. • ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 21-4

Consult a Joy Engineer

For AIR COMPRESSORS, ROCK DRILLS, CORE DRILLS, HOISTS and SLUSHERS, MINE FANS and BLOWERS

JOY

WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING EQUIPMENT

W&D M5653-21

Ever see a stronger-looking drift?

Strength and safety rule supreme in this progressive ore mine, where Bethlehem's Yieldable Arch mine roof support is heavily employed. It's hard to imagine a cave-in or subsidence here!

The Yieldable Arch is formed of steel, which means it has both strength and durability. Each Yieldable Arch set consists of rolled-steel segments, heavily flanged to resist torsion and designed to nest into one another at points of overlap. Joints are made with U-bolt clamps drawn tight enough to hold fast under normal loads. When unusually heavy pressures begin to bear down, the joints permit the nested segments to slide or yield before deformation of the steel can occur. The load is thus relieved and the structural integrity of the arch is maintained.

Horizontal braces or struts, secured to the arches by special J-bolt clamps, tie the arches together and contribute lateral stability to the structure. Lagging, such as the type shown in the illustration, is recommended wherever possible for maximum effect.

A Bethlehem engineer would like to discuss the Yieldable Arch in full detail with you, without any obligation on your part, of course. A visit to your workings would be helpful to him in making recommendations, and he will be glad to arrange such a trip at your convenience.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

new, improved PAYLOADER® tractor-shovel

model HO
2¼ cu. yd. CAPACITY
7,500 lbs. @ 4 mph

Bigger Capacity–Better Performance

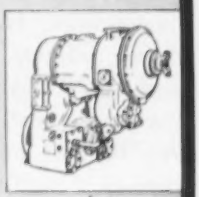
This new 1956 model HO has a bucket capacity of 2¼ cu. yd. payload, 1¾ cu. yd. struck . . . is the biggest capacity "PAYLOADER" ever offered, and outstanding by any measure. Pound for pound, it's way ahead of the field in digging power and carrying capacity. The famed Hough bucket motion has powerful pryout action and 40° tip-back at ground level to *get* big loads and *hold* big loads without spilling.

It has power brakes, power steer and power shift . . . is more maneuverable . . . faster and easier operating and easier riding — with or without a load. It delivers better, more reliable traction over a wider range of ground conditions than any wheeled tractor-shovel *ever* has. It has balanced design and durability *throughout* to deliver big yardage day after day without interruption.

If you want the last word in a big husky tractor-shovel, insist on a model HO. Your "PAYLOADER" Distributor has all the facts.

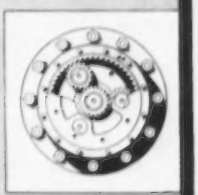
Complete Power-Shift Transmission

The fastest and easiest-operating transmission ever built. All shifts can be made instantly, on-the-go, under full engine speed. There's no stopping for a RANGE shift, there's no foot clutch. With the forward-reverse control the operator can "creep" the machine at full engine speed, in any gear, while maintaining full bucket action . . . all this plus torque converter drive.



Planetary Final Drives

Rugged planetary final drives in the wheel hubs, plus hypoid differential gearing, keep torque low in axles . . . prolong life of axles and all drive train parts. Torque-proportioning differentials assure effective traction under slipping conditions. If one wheel starts to slip more power is delivered to the opposite wheel.



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Send full information on "PAYLOADER" 4-wheel-drive tractor-shovels.

☐ model HO—2¼ cu. yd. ☐ model HH—1½ cu. yd.
☐ model HU—1 cu. yd.

NAME _____
TITLE _____
COMPANY _____
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CITY _____
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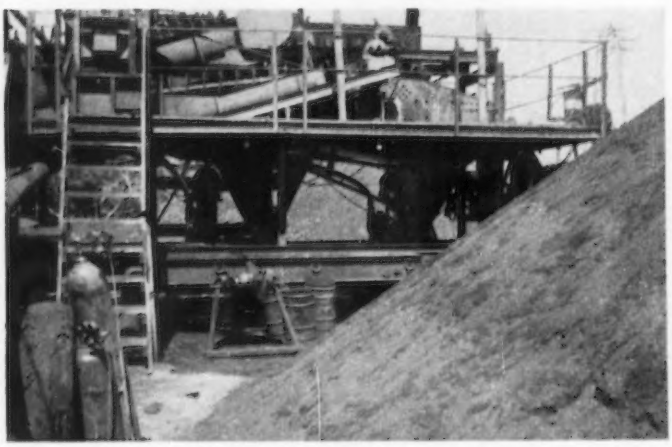
NOW all the advantages of AKINS HMS Separators and AKINS EXPERIENCE

IN A *TRANSPORTABLE* UNIT

1938... Akins on Heavy Media. Experimentation on the use of Akins Spiral Classifiers in making a sink and float separation was first started in 1938. Continuous research, on pilot plant and commercial scales, resulted in development of the Akins Separator...a modification of the classifier which retains all of the important mechanical features of the Akins. In 1944 the first 78" Akins Separator was placed in successful operation by one of the large iron mining companies.

This compact unit, mounted on a flat bed truck trailer, was designed and built by S. E. Hollister, Consulting Engineer, Los Angeles. It is ideal for small commercial operation or for low cost pilot plant work. It includes a 24" Akins Separator and a 16" Akins Densifier.

The unit shown has been used successfully on two different manganese oxide ores, handling 25 tons per hour. On one property it easily met the stockpiling program specifications; on the company's other property it produced a concentrate with better than 40% MnO_2, for direct carload shipment.



This unit is achieving outstanding results, in both grade and recovery, through extraction of middlings... **taking advantage of Akins' ability to make a 3-product separation in one machine, requiring only one media circuit.**

Proved Facts about AKINS SEPARATORS

• 3-product separation in one machine, requiring only one media circuit. • Start-up under full load. • Entire vessel is visible and accessible. • Variation in rate or grade of feed is not detrimental. • Large pool area and volume minimize tramp refuse in the product and facilitate better recovery of values from fine sizes. • Gradation of gravity and viscosity from feed entry point to sink removal point provides natural cleaning of sink, and allows circulation of media at lower gravity and viscosity.

YOU can have the advantage of this AKINS EXPERIENCE just write, wire or call...

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Three characteristics give J&L CenterFit Wire Rope the staying power to develop outstanding service in applications where shock, fatigue and heavy loading limit the service life of standard wire rope.

1. CENTERFIT is the strongest standard rope produced.
2. CENTERFIT is more flexible in operation than any standard IWRC rope.
3. CENTERFIT has unsurpassed resistance to shock loading.

Over the years CenterFit has built a record for outstanding service life on the toughest applications such as shovel hoist ropes, back hoe pull ropes, and clamshell holding and closing lines where overloading is a factor. Contact your nearest J&L Office or representative.

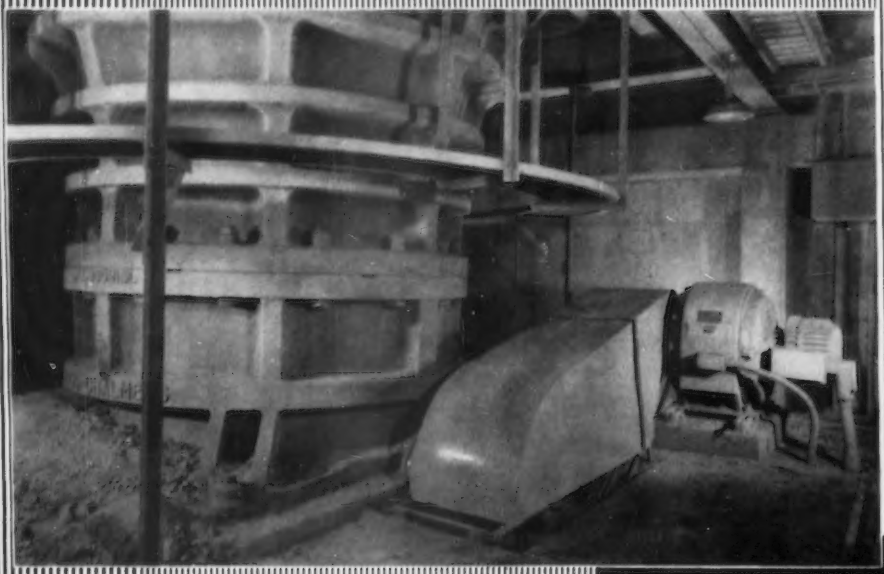
Jones & Laughlin
STEEL CORPORATION — *Pittsburgh*

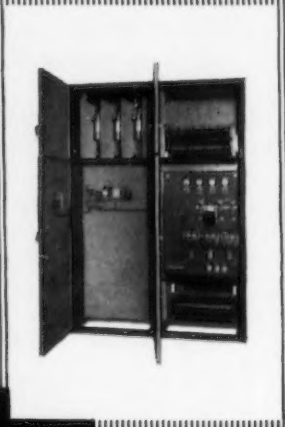
Unsurpassed!

How "COORDINEERING" at ... Better

"Coordineering" may be defined as the integration of advanced thinking, planning and engineering that precedes the application of Allis-Chalmers equipment. With its staff, skill and experience, Allis-Chalmers is in a unique position to provide this valuable service.

Allis-Chalmers designs and builds all basic types





Crushing

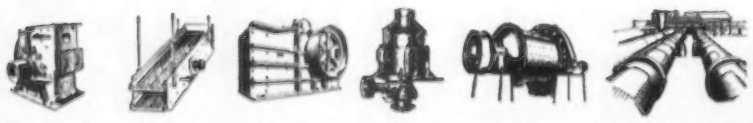
An example of Allis-Chalmers "coordineering" is this crusher installation. Drawing on 75 years' experience in building and applying crushers, Allis-Chalmers control and crushing engineers developed a control circuit designed to cut costly downtime for the crusher installation shown above. In this circuit, motor overload protection is provided by *two* sets of thermal overload relays. One set operates at slight overload to sound warning. The second set stops the motor when temperature reaches the danger point.

Because of high starting torque and frequent starting under load, an Allis-Chalmers wound-rotor motor is used. In calculating horsepower requirements, the factors of crushability, ratio of reduction, product size and specific gravity are evaluated.

Flexibility in the Crusher

The crusher is the *Superior* gyratory crusher which features "one-man, one-minute" positioning of mainshaft and mantle. This control facilitates emptying crushing chamber in case of power failure or other emergencies. It also compensates for wear on concaves and mantle and, when required, changes product size instantly. In Allis-Chalmers gyratory crushers, changing eccentricity, speed, or shape of chamber varies capacity and product size. This flexibility permits synchronizing crushing with other operations.

Superior is an Allis-Chalmers trademark.



Hammermills | Vibrating Screens | Jaw and Gyratory Crushers | Grinding Mills | Kilns, Coolers, Dryers

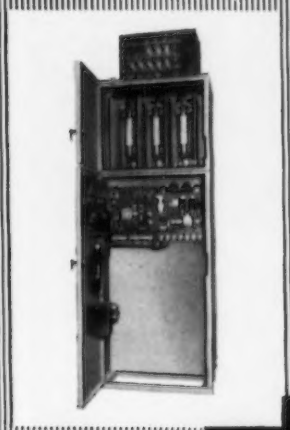
ALLIS-

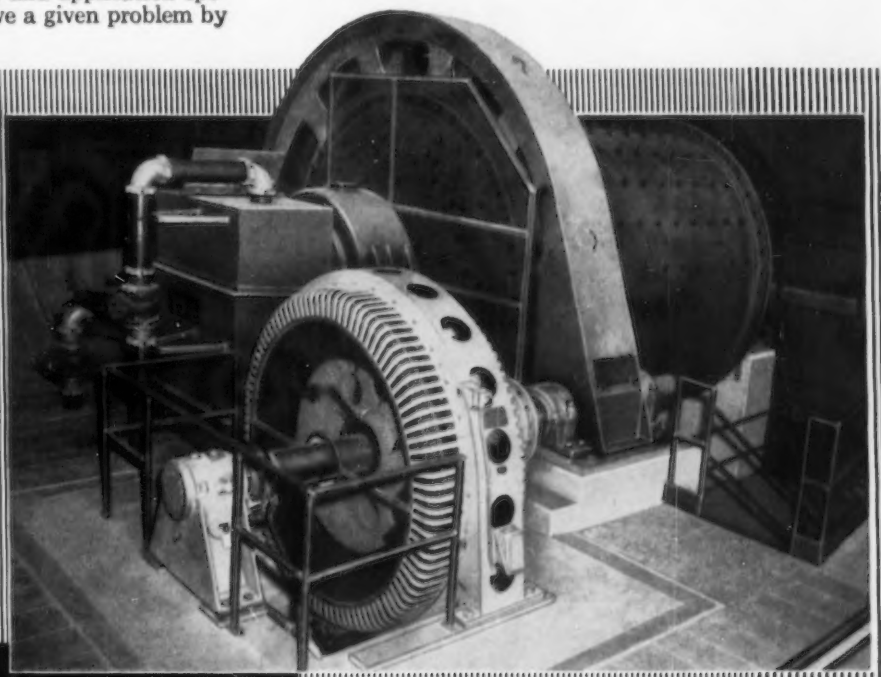
Allis-Chalmers Provides Better Methods

Results for You!

of processing machinery. In addition, the company manufactures complete lines of electrical generation, distribution and utilization equipment. As a result, Allis-Chalmers has a tremendous reservoir of experience—a most diversified team of research, engineering, manufacturing and application specialists — specialists who solve a given problem by exchanging ideas and correlating specific know-how and skills.

Only Allis-Chalmers can give you truly integrated equipment — because only Allis-Chalmers can give you "coordineering."





Grinding

In solving a grinding application, requirements and variables are given a careful going over by an Allis-Chalmers team comprised of *grinding*, *motor* and *control* engineers. Characteristics of material, capacity, feed preparation, balance of gradations, torque characteristics, system power factor needs, control requirements are some of the many factors evaluated. Experience has proved that this thorough pre-application investigation and preparation pays off to the purchaser . . . *pays off in providing a modern, efficient grinding circuit with the lowest operating cost.*

An Integrated Grinding Mill Installation

In a typical application, the mill installed was a 10½ by 12-foot Allis-Chalmers diaphragm ball mill. The close diameter-length ratio is an important factor in producing the highest possible capacity per unit of power. Driving the mill is a 900-hp, 4000-volt, 257-rpm, 0.8 pf Allis-Chalmers synchronous motor. By providing desired power factor correction, this motor reduces power cost. The Allis-Chalmers starter is specially engineered to provide protection under all conditions of grinding operation. A-4915

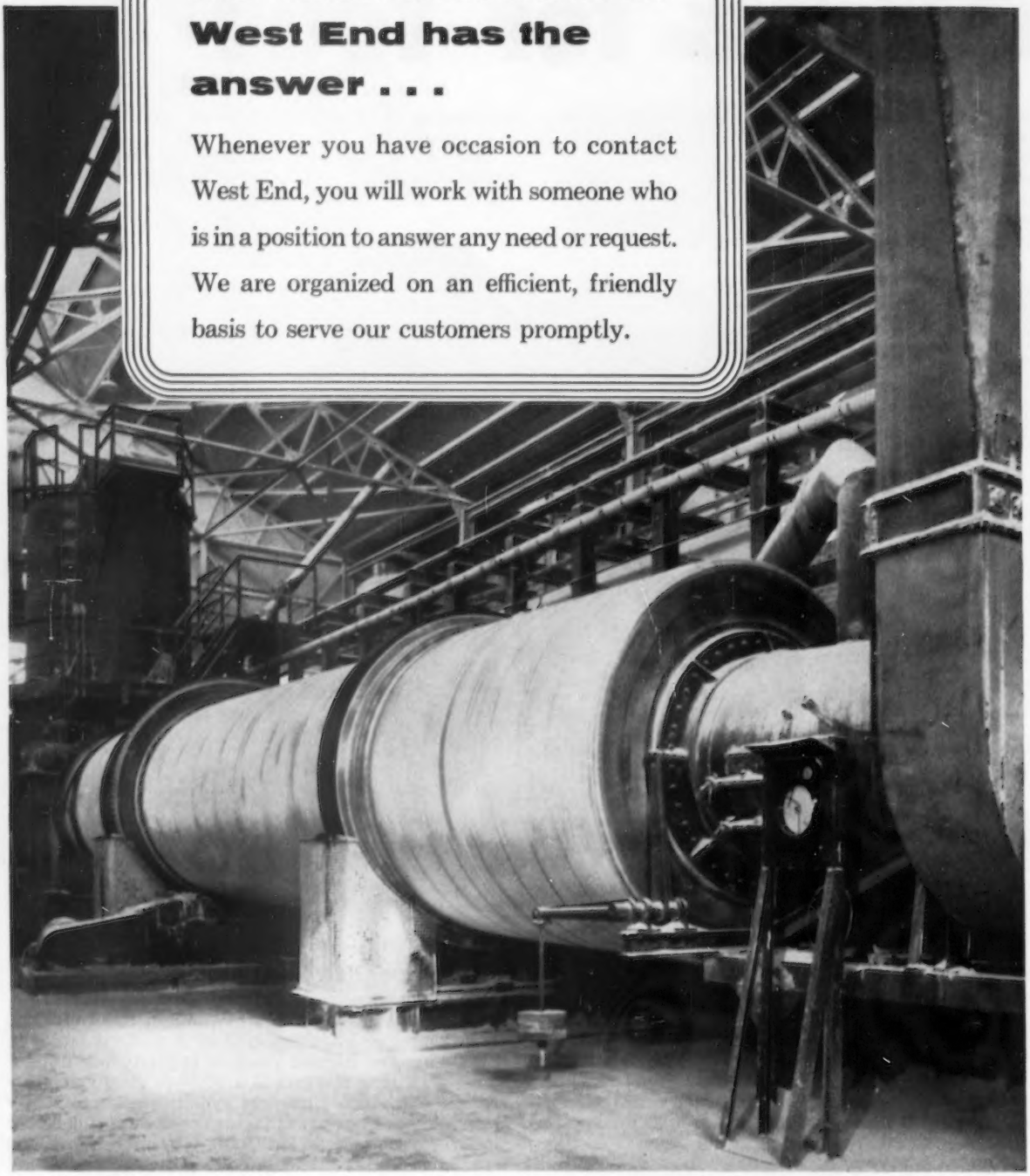
★ **You'll want Bulletin 25C6166D.** It covers all equipment manufactured by Allis-Chalmers for the mining industries. See your nearby A-C representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

CHALMERS

A-C ALLIS-CHALMERS

the soda ash man at West End has the answer . . .

Whenever you have occasion to contact West End, you will work with someone who is in a position to answer any need or request. We are organized on an efficient, friendly basis to serve our customers promptly.



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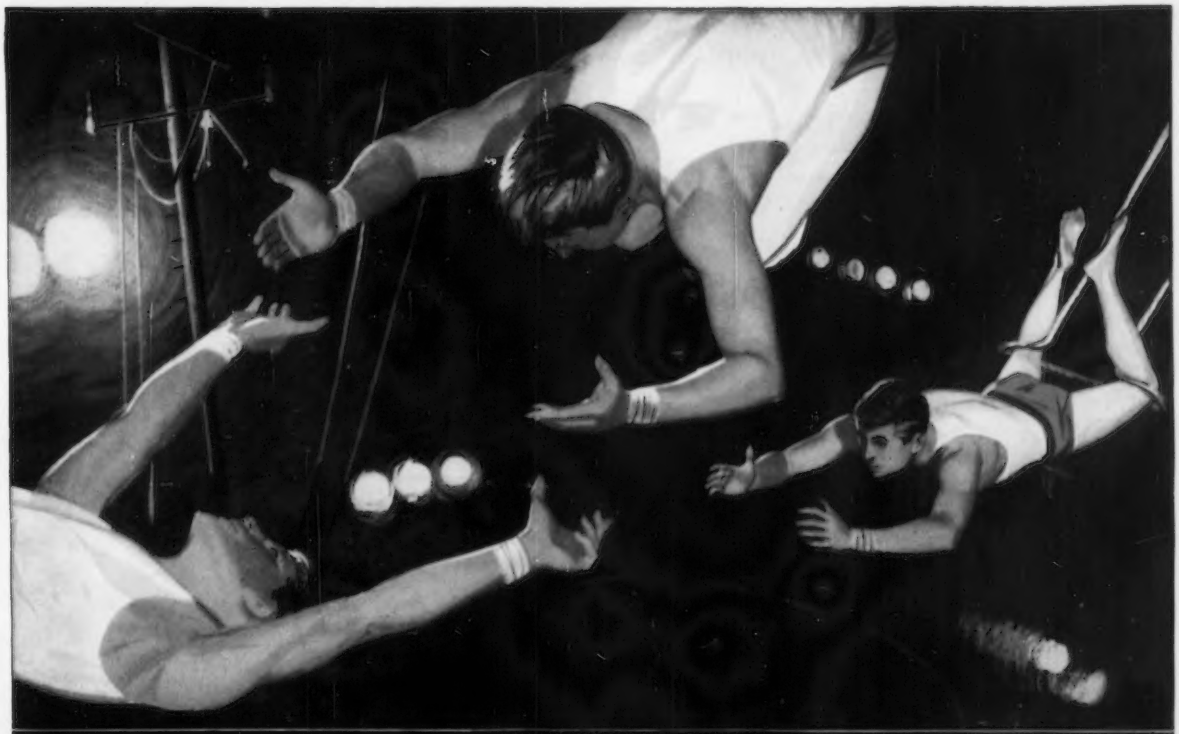


TOPS IN TEAM WORK—ALL THREE

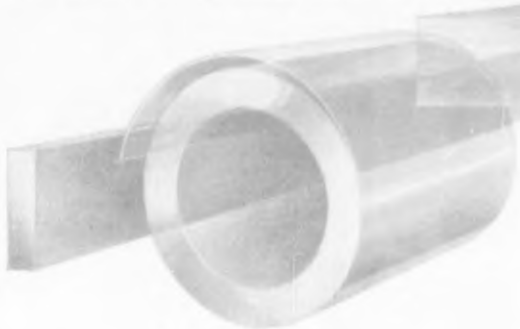
each does a special job

J&L's JALTEN series offers you three top performing high strength, low alloy steels with the following characteristics:

JALTEN NO. 1—High strength, good formability and fabricating—good resistance to low temperature impact.

JALTEN NO. 2—High strength, moderate forming—improved resistance to atmospheric corrosion.

JALTEN NO. 3—High strength—improved abrasion resistance.



J&L STEEL

SEND FOR THIS NEW BOOK:
Chemical properties of Jalten
Mechanical properties of Jalten
Jalten equivalents
Jalten application data

Jones & Laughlin Steel Corporation
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Pittsburgh 30, Pennsylvania

Please send a copy of your Jalten booklet, *JALTEN LOW-ALLOY, HIGH-STRENGTH STEEL.*

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Jones & Laughlin
STEEL CORPORATION – *Pittsburgh*

5 "Euc" REAR-DUMPS

10-Ton

The Model UD has a 6½ cu. yd. body and rated payload of 20,000 lbs.—a quarry body with flared sides is available for rock work. Designed for smaller mine, quarry and construction work, this Rear-Dump has a 128 h.p. engine and 10-speed transmission providing a top speed of 36 m.p.h. Drive axle is spring mounted—tires are 11.00 x 24 front with 12.00 x 24 rear duals.

15-Ton

There are two models of this capacity "Euc". One has a 10 cu. yd. body, 165 h.p. engine, semi-rigid drive axle and manual steering—the other has a 218 h.p. engine, 10½ yd. body, spring mounted drive axle and hydraulic steering. The latter model can be equipped with larger tires to increase the rated payload to 18 tons. Both have 5 speed transmissions and 14.00 x 24 tires standard—a quarry body for either model is available.

22-Ton

Practically a "standard" on larger quarry, mine and heavy construction projects, the Model TD "Euc" has a 300 h.p. engine, spring mounted drive axle, and 15 yd. body. Tires are 14.00 x 24 front with 18.00 x 25 duals rear. Hydraulic steering is standard, and a quarry body is available. This "Euc" can be equipped with a 10-speed transmission or Torqmatic Drive—it's a top performer on the toughest jobs.

EUCLID DIVISION, GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

10 to 50 TONS—128 h.p. to 600 h.p.

A Complete Line of Off-highway Haulers

34-Ton

This Twin-Power tandem axle "Euc" has two engines providing a total of 400 or 436 h.p.—each engine drives an axle through a separate Torqmatic Drive. The exhaust heated body has a capacity of 24 yds. Tires are 16.00 x 25 front, with 16.00 x 25 rear duals in tandem. For jobs where large loading equipment is used and big loads must be hauled, the Model FFD has no equal for low cost production and performance.

for

CONSTRUCTION, MINE, QUARRY and INDUSTRIAL WORK

Rear-Dump "Eucs" are the outstanding choice for moving heavy excavation on the toughest jobs because they are built exclusively for off-the-highway service. They have the capacity, power and speed to haul big loads faster and at lower cost per ton or yard moved.

The simple, rugged construction of Euclid Rear-Dumps pays off in long life and low maintenance cost. There's less down time for repairs . . . more work-ability. These "Eucs" have engines of 128 to 600 total h.p. . . . single and tandem drive axles . . . standard or quarry type bodies . . . gear transmissions and Torqmatic Drive . . . spring mounted and semi-rigid drive axles . . . top speeds, with full payload, up to 36 m.p.h.

Wherever you see Rear-Dumps in off-highway work, it's almost a sure thing they are "Eucs" because Euclid has been the leader in this field for over 20 years. There are more Rear-Dump "Eucs" in service than all other makes of off-highway haulers combined. Have your Euclid dealer supply helpful data on this complete line of Rear-Dumps and other Euclid earth moving equipment . . . you may find, as hundreds of owners already have found, that ***Euclids are your best investment.***

50-Ton

Largest Rear-Dump hauler in standard production, the Model LLD Euclid is designed for the biggest, toughest jobs. It has two engines, providing a total of 600 h.p.—each of the spring mounted drive axles is driven through separate Torqmatic Drives. The exhaust heated body has a 32 yd. capacity. All tires are 18.00 x 33. Twin Euclid hoists have ample power to raise the fully loaded body fast for quick, clean dumping.

Rear-Dump "Eucs" are your best bet

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

WILFLEY

CENTRIFUGAL SAND PUMPS

The rubber-lined Wilfley Sand Pump shown here is typical of Wilfley installations throughout the world. Wilfley sand pumps are also available with interchangeable hard alloy iron parts to meet the requirements of every installation. Write, wire or phone for complete details.

Individual Engineering ON EVERY APPLICATION

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EUCLID
FOR MOVING EARTH, ROCK, COAL AND ORE

ENGINEERING AND MINING JOURNAL

APRIL 1956

What It Takes to Produce A Pound of Copper

VISITORS who view San Manuel's headframes, modern surface plant and railroad today can scarcely believe that 15 years ago this same Arizona property was nothing but a patch of barren cactus-covered rolling desert. Hidden beneath that desert area lay a 500-million-ton copper orebody capped by a thick barren conglomerate.

Emergence of San Manuel from a dubious prospect to one of the nation's leading underground copper mines is not just another mining story. It's an epic account of a team of mining men who recognized a good thing when they saw it and had the courage to push their plans through many obstacles to fruition. That story is told in "Men Who Made San Manuel" which starts on p. 76.

The raising of many millions to finance this huge undertaking was itself a major accomplishment. Before an RFC loan could be negotiated, millions of dollars of private venture capital had to be risked to answer questions such as these: How extensive is the orebody? Is the grade high enough to be commercial? Can the minerals be concentrated economically? Can the orebody be drained? Will it cave? A negative answer to any one of these questions might easily have scuttled the project in its infancy. Fortunately the skilled proficiency of the company's staff in exploration, mining and metallurgy proved that San Manuel was potentially an economic project. However, the task yet remained to raise some $94-million to finance the project. It was here that the faith and persistence of A. J. McNab, chairman of the board of San Manuel, contributed so much to the success of the venture.

The historical account of San Manuel also reveals the great assistance rendered by the U. S. Bureau of Mines, the U. S. Geological Survey and the RFC. San Manuel's officers are quick to acknowledge the valuable cooperation of these agencies.

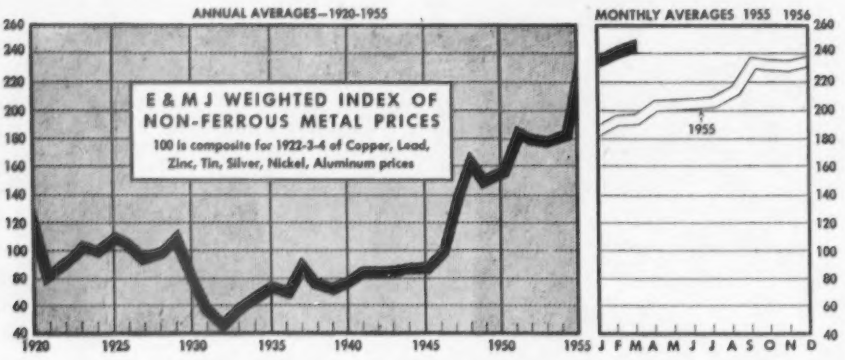
Following the financing, came an intensified mine development and plant construction program which enabled San Manuel to pour its first pound of anode copper six months ahead of schedule.

E&MJ's feature article shows the modern townsite, surface and underground mine plant, complete standard-gage railroad, 30,000-ton concentrator and smelter designed to produce about 70,000 tons of copper per year. All of this is necessary for the economic extraction of less than 16 lb of copper from each ton of ore mined. With butter selling currently at 79c a lb, it would seem that copper is a bargain commodity!

San Manuel's contribution to the nation far exceeds the 70,000 tons of copper and 3,000 tons of molybdenite concentrates it plans to produce each year. When operating at capacity this project will require 1,850 to 2,000 employees with an estimated payroll of $11-million annually. Families of the employees will be housed in an entirely new 1,000-dwelling townsite. Schools, hospital facilities, shopping centers and recreation plots have been built to provide all with the finest benefits offered by modern society. The State of Arizona will experience a tremendous social lift as a result of this project. In short, the sale of a pound of copper buys more than just plant, materials and services. It buys a new way of life for thousands of people for decades to come.

E&MJ OUTLOOK

PRICES



MARKETS

Copper drove *E&MJ*'s price index more than six points skyward to 248.28 for March as compared with 241.49 for February. The late increase in the aluminum price in March had little effect on the index. Other major non-ferrous metals were fairly steady.

The drop in premium prices for copper of about 5c per lb during the last week in March is interpreted to be the beginning of a return to normalcy in world copper prices.

Forecasters see a whopping increase in steel prices this year if costlier labor demands are to be met. Boosts up to $9 per ton have been cited.

AT HOME

Company earnings now being reported for 1955 have gone up impressively in the mining industry. Heavy investment in Government securities by many of the reporting companies may indicate a short-term conservative outlook.

President Eisenhower recommended to Congress that the Government sell the Texas City tin smelter to private interests. The sale may be made this year.

Foley Metals Corp., partly owned by Foley Brothers, Inc. of New York, is negotiating with the Atomic Energy Commission to build a uranium processing mill to treat ores from the Ambrosia Lake area near Grants, N. M.

The effect of minute quantities of hydrogen on titanium has baffled metallurgists and delayed major titanium applications in aircraft by about two years. Solution of this and other technical problems now places titanium in the favored position predicted about 10 years ago.

LABOR

Labor specialists look for a clash between Mine-Mill and AFL-CIO Steelworkers in a struggle for control of bargaining rights in the non-ferrous mining industry. See p 120.

Mine-Mill expects to exert political action in 13 senatorial races, and 40 important House contests this year.

ABROAD

France and the Soviet Union are competing in offers of economic aid to Yugoslavia to exploit copper deposits at Majdanpek, eastern Serbia. Under Yugoslav plans, Majdanpek could produce 23,000 tons of blister copper per year.

Vouksenniska Inc. has been exploring submerged iron ore deposits off the coast of Finland; one in the Aaland Islands, and the other in the archepelago off Tammisaari. Frogmen have been employed to obtain samples.

West German sources say that uranium mined in the Soviet zone of Germany amounts to 3 to 4% of the world's uranium output. Over 100,000 forced laborers are presently employed in the uranium mines according to the West German economic journal "Volkswirt."

East German experts and Indian Government representatives are talking over plans to make steel with Indian lignite.

Copper Prices Drop 6c in London
Aluminum Prices Raised 1½c in U. S.

March economic activity was at a high rate but probably down a little from the maximum level of December. *E&MJ* estimates industrial production for March at 143% of the 1947-49 average.

Non-ferrous metal prices rose in March to 248.10% of the 1922-24 average, up 6.6 points from February, according to the *E&MJ* index of non-ferrous metal prices. The increase in copper from 44.588c to 46.728c brought the index up. Aluminum price increases had a little effect.

Copper prices rose in March both here and abroad but near the end of the month there was a sharp down turn which many factors interpreted as the beginning of the long-expected decline. In London prompt copper was about 54½c a lb on March 19; on March 27 it was about 48.7c. The price of resale copper and custom smelter metal in the U. S. dropped from about 54½c to about 50c. The fall was the result of a number of factors. For several months copper buying by fabricators had been under the level of last fall. To some extent this reflected the deflationary policy of the U.K. Government but there had been indications of a decline elsewhere in Europe. Some fabricators found the cost of holding inventories excessively high, but in considerable part they saw a decrease in demand for copper containing products. Some fabricators report the same for the U. S. Copper Institute figures show deliveries of copper to fabricators in February, outside the U. S., were 97,458 short tons, the lowest since July 1955 and previous to that March 1954. It was more than 10% below the 1955 monthly average and about 6% below the 1954 monthly average. Refined stocks outside the U. S. have been increasing for several months.

Most factors seem certain it has been largly pressure by the Chilean Government that kept prices up to present levels in Europe. They suggest London prices would have fallen earlier except for the belief Chile would force up the price in the U. S. The trouble in the Near East also had an upward pressure on prices.

Anaconda announced about noon March 16 that after the close of business that day its price for copper of Chilean origin would be sold at a uniform basis in the U. S. and abroad. It has been the opinion of many factors that Anaconda still held that copper prices were much too high for the producing and consuming industries. The new price basis was the mean of the London Metal Exchange first session for prompt copper less 0.7c to put it on a U. S. delivered basis rather than a European basis. There were statements that beginning with March 26 deliveries in the U. S. of Kennecott's copper of Chilean origin would also be on an LME basis; on April 2 Kennecott began selling its Chilean copper at the LME price for the week of shipment from Chile. Anaconda, beginning April 2, is selling its Chilean copper at the mean of the prompt LME, first session price for the week preceding the week of shipment. There is no deduction from the LME price to offset ocean freight and insurance costs from the company's refinery here to Europe.

A major fabricator of copper products, Revere Copper and Brass, independent of the producers, announced that on March 14 the price of its copper products would be based on 49c copper. The firm indicated that that had been the average price it paid for copper. Many independents soon followed. Anaconda's subsidiaries raised to 49c effective March 19. With the average price of copper falling in the last week of March, some consumers wonder if product prices will come down. Kennecott's Chilean output is much less important as a proportion of its total operations; there have been no announcements that its product prices are being raised.

Near the end of March, arrangements were completed for the Chilean Government to set up an Exchange Stabilization Fund. The International Monetary Fund is lending $35-million, the U. S. Treasury $10-million and private U. S. banks $30-million. This fund will permit the Chilean Government to establish a single and relatively free foreign exchange rate for the dollar and other currencies. This would alleviate some of the pressing problems of the copper companies in Chile. Copper Institute data follow:

United States

	1956 Jan.	Feb.
Production:		
Crude, primary	96,732(a)	89,491
Crude, secondary ...	10,353(a)	11,547
Totals	107,085(a)	101,038
Refined copper	123,798	127,917
Deliveries, refined	130,431(a)	139,383
Stock at end, ref'd. ..	50,016	47,053

Outside United States

	Jan.	Feb.
Production:		
Crude, primary	137,165(a)	138,918
Crude, secondary ...	897	1,808
Totals	137,962(a)	140,726
Refined copper	113,502	115,541
Deliveries, refined	111,994	97,458
Stock at end, ref'd. ..	167,299	179,683

(a) Corrected figures.

About March 27, U. K. Chancellor the Exchequer Macmillan, in his economic report for 1956, strongly implied present deflationary moves in the U. K. were insufficient. The object is, primarily, to increase exports via lower U. K. prices, and perhaps decrease imports. The intent is to maintain the country's foreign payments in balance by use of non-financial items. He singled out the metal industries as having imported excessively and indicated demand had been much too high for metals. He implied special efforts would be made to bring prices down.

Primary pig aluminum in the U. S. as measured by the *E&MJ* weighted average rose from 22.5c a lb to 22.721c, and ingot from 24.4c to 24.621 for the month of March. Kaiser Aluminum & Chemical Corp. announced a 1½c per lb price rise effective March 26, for aluminum and aluminum products. Reynolds Metals raised its prices for primary metal and products by the same amount effective March 27, and Anaconda and Alcoa followed March 29. Alcan raised its price by the same amount for aluminum delivered in the U. S. effective March 31. It raised its Canadian price to Canadian consumers to 23½c effective the same day.

Reynolds Metals said assurance of sufficient aluminum supplies depends on an adequate price. To expand capacity to meet rising needs, financing must be obtained. The company said the return on new investments was too low. Prices of secondary aluminum rose about 1½c a lb following the primary price increase.

Lead prices remained at 16c N. Y. all month. Toward the end of the month some factors indicated some signs of weakness but none expected a price fall. The Government came into the market for lead late in the month and probably got a little more than in the past few months. Most feel the Government buying program will maintain the price at 16c

Zinc remained at 13½c East St. Louis all month. Sales were a little under the maximum reached late in 1955 but some sellers felt this would give them an opportunity to build stocks of Special High Grade to meet an expected higher demand when production of autos picks up. Prime Western continued in good demand.

A summary of the January and February 1956 statistics of the American Zinc Institute, in short tons, follows:

	Jan.	Feb.
Stock at beginning	40,979	41,330
Production	90,313	86,329
Production, daily rate	2,913	2,977
Shipments:		
Domestic	87,723	84,727
Export & drawback	1,084	317
Government acc't.	1,155	2,782
Totals	89,962	87,826
Stock at end	41,330	39,883
Unfilled orders	60,717	45,255

Quicksilver prices continued their downward trend. They opened the month at $264 per flask but at the end of the month they were $257 per flask. There was some expectation producers from abroad were decreasing shipments here so some factors thought the price might firm up.

Average Prices March (E&MJ Quotations)

Copper:	
Electrolytic, domestic refinery	46.728
Electrolytic, export refinery	48.532
Lead:	
Common, New York	16.000
Common, St. Louis	15.800
Silver and sterling exchange:	
Silver, New York, per oz.	91.143
Silver, London, pence per oz.	78.982
Sterling Exchange, "Checks"	280.494
Zinc:	
Prime Western, East St. Louis	13.500
Prime, Western, delivered (g)	14.000
Tin:	
New York Straits	100.616
New York, 99% min. (e)	99.616
Gold, per oz. U. S. price	$35.000
Quicksilver, per flask	$258.778
Antimony (*E&MJ*) (d)	36.470
Antimony, bulk, Laredo	33.000
Antimony, in cases, Laredo	33.500
Platinum, refined, per oz.	$103.000
Cadmium (a)	170.000
Cadmium (b)	170.000
Cadmium (c)	170.000
Aluminum, 99% plus ingot	24.621
Magnesium, ingot	32.500
Nickel (f)	64.500

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotations.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lots, packed in case f.o.b. New York.

(e) Tin content.

(f) F.o.b. Port Colborne, U.S. duty included.

(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

Trading volume rose 9% in March. Coins remained in active demand throughout the globe, with prices dropping in Chile, due to a partial stabilization of the peso. Canada's freeing of gold had no noticeable effect in markets. African trading remained lively due to continued political unrest. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	COINS		BARS (12.5 dg)	
	Feb. 29	Mar. 31	Feb. 29	Mar. 31
NEW YORK, transit	.....	.....	$35.15	$35.15
MANILA	$40.75	$41.25	36.25	36.00
HONG KONG	43.40	44.30	38.00	38.10
BOMBAY	53.50	56.80	53.00	55.00
TANGIER	41.50	43.00	34.94	34.92
BEYROUTH	43.25	43.00	35.13	35.11
PARIS	42.00	42.85	35.95	35.85
BUENOS AIRES	38.50	38.25	36.00	36.10

Note: Prices are computed at the free or black market value of the U. S. dollar in the local markets.

Major Metals

U. S. DAILY AND AVERAGE PRICES

Mar. 1956	Electrolytic Copper (a) Domestic	(b) Export	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99%	Straits Tin New York
1	47.350	46.975	16.000	15.800	14.000	13.500	22.500	101.000
2	46.525	48.900	16.000	15.800	14.000	13.500	22.500	100.125
3	No Market	48.900	16.000	15.800	14.000	13.500	22.500	100.125
5	46.400	47.725	16.000	15.800	14.000	13.500	22.500	100.750
6	46.900	47.925	16.000	15.800	14.000	13.500	22.500	101.625
7	46.850	47.225	16.000	15.800	14.000	13.500	22.500	101.500
8	47.200	48.600	16.000	15.800	14.000	13.500	22.500	101.375
9	47.525	49.175	16.000	15.800	14.000	13.500	22.500	101.375
10	No Market	49.175	16.000	15.800	14.000	13.500	22.500	101.375
12	47.075	48.075	16.000	15.800	14.000	13.500	22.500	101.875
13	47.800	48.325	16.000	15.800	14.000	13.500	22.500	101.875
14	47.725	47.725	16.000	15.800	14.000	13.500	22.500	101.750
15	46.600	48.775	16.000	15.800	14.000	13.500	22.500	102.250
16	46.275	50.100	16.000	15.800	14.000	13.500	22.500	101.375
17	No Market	50.100	16.000	15.800	14.000	13.500	22.500	101.375
19	46.050	49.050	16.000	15.800	14.000	13.500	22.500	100.750
20	46.500	48.650	16.000	15.800	14.000	13.500	22.500	100.750
21	46.475	48.050	16.000	15.800	14.000	13.500	22.500	100.625
22	46.850	50.625	16.000	15.800	14.000	13.500	22.500	99.125
23	46.525	47.875	16.000	15.800	14.000	13.500	22.500	98.625
24	No Market	47.875	16.000	15.800	14.000	13.500	22.500	98.625
26	46.450	47.725	16.000	15.800	14.000	13.500	22.848	98.875
27	46.600	47.525	16.000	15.800	14.000	13.500	23.196	99.125
28	46.275	47.825	16.000	15.800	14.000	13.500	23.196	100.375
29	46.175	49.475	16.000	15.800	14.000	13.500	23.865	100.000
30	45.900	49.000	16.000	15.800	14.000	13.500	23.865	100.000
31	No Market	49.000	16.000	15.800	14.000	13.500	24.000	100.000
AVERAGES FOR MONTH								
Mar.	46.728	48.532	16.000	15.800	14.000	13.500	22.721	100.616
AVERAGES FOR WEEK								
Mar.								
7	46.805	47.942	16.000	15.800	14.000	13.500	22.500	100.854
14	47.465	48.513	16.000	15.800	14.000	13.500	22.500	101.604
21	46.380	49.121	16.000	15.800	14.000	13.500	22.500	101.188
28	46.540	48.242	16.000	15.800	14.000	13.500	22.790	99.125
CALENDAR WEEK AVERAGES								
Mar.								
3	46.415	48.008	16.000	15.800	14.000	13.500	22.500	101.833
10	46.975	48.304	16.000	15.800	14.000	13.500	22.500	101.333
17	47.095	48.850	16.000	15.800	14.000	13.500	22.500	101.750
24	46.480	48.688	16.000	15.800	14.000	13.500	22.500	99.750
31	46.280	48.425	16.000	15.800	14.000	13.500	23.495	99.729

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Mar. 1956	Silver (c) New York	Silver London	Sterling Exchange "Checks"	Gold London	Gold (d) United States
1	91.000	78.875d.	280.8125	249s. 1d.	$35.00
2	91.125	78.875d.	280.7178	249s. 3d.	35.00
3	(e)	(e)	(e)	(e)	35.00
5	91.125	78.875d.	280.3385	249s. 4½d.	35.00
6	91.125	79.000d.	280.1770	249s. 8½d.	35.00
7	91.125	79.000d.	280.2812	249s. 7½d.	35.00
8	91.125	79.000d.	280.4218	249s. 7½d.	35.00
9	91.125	79.000d.	280.4241	249s. 6¾d.	35.00
10	(e)	(e)	(e)	(e)	35.00
12	91.125	79.000d.	280.4375	249s. 6¾d.	35.00
13	91.125	79.000d.	280.5625	249s. 4¾d.	35.00
14	91.125	79.000d.	280.6383	249s. 4¾d.	35.00
15	91.125	79.000d.	280.6026	249s. 4¾d.	35.00
16	91.125	79.000d.	280.5312	249s. 4½d.	35.00
17	(e)	(e)	(e)	(e)	35.00
19	91.125	79.000d.	280.5625	249s. 4¾d.	35.00
20	91.125	79.000d.	280.6517	249s. 4¾d.	35.00
21	91.125	79.000d.	280.6026	249s. 3½d.	35.00
22	91.125	79.000d.	280.5416	249s. 4¼d.	35.00
23	91.125	79.000d.	280.4687	249s. 5¼d.	35.00
24	(e)	(e)	(e)	(e)	35.00
26	91.250	79.000d.	280.4732	249s. 5¼d.	35.00
27	91.250	79.000d.	280.4866	249s. 5¼d.	35.00
28	91.250	79.000d.	280.5000	249s. 5¾d.	35.00
29	91.250	79.000d.	280.2991	249s. 5¾d.	35.00
30	Holiday	Holiday	280.3437	Holiday	35.00
31	(e)	(e)	(e)	(e)	35.00
AVERAGES FOR MONTH					
Mar.	91.143	78.982	280.494		35.00
AVERAGES FOR WEEK					
Mar.					
7	91.100	—	280.466	—	35.00
14	91.125	—	280.497	—	35.00
21	91.125	—	280.590	—	35.00
28	91.200	—	280.494	—	35.00

Calendar Week Averages: New York Silver: March 3rd, 90.875; 10th, 91.125; 17th, 91.125; 24th, 91.125; 31st, 91.250.

(e) No Market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c per pound, the average differential for delivery charges.

(b) Our export quotations for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West, effective Jan. 1, 1951, commanded a premium of 1.35c per pound over the current market for Prime Western; Special High Grade 1.75c effective Dec. 1, 1955.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 pounds.

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U.S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

London Metal Exchange Quotations

Mar.	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
1	422	423	410	411	122	122½	117¾	118	101¾	102	98¼	98½	830	835	787½	790
2	417	417½	405½	406	121¼	121½	117	117¼	101	101½	97½	97¾	810	812	775	777½
5	425	426	412	414	122	122¼	118½	118¾	101¾	102¼	98½	98¾	805	820	775	780
6	433	434	419	420	124	124¼	120½	121	103½	104	100	100¼	830	832½	790	792½
7	433	434	418	420	123¼	123¾	120	120¼	102½	103	99½	99¾	835	837½	792½	795
8	425	426	414	415	122	122¼	118½	118¾	102	102½	99	99¼	825	830	785	786
9	425	426	414	415	121¾	122	118¾	119	101¾	102¼	98½	98¾	830	835	793	795
12	424	425	413	414	120¾	121	118	118½	102¼	102¾	99¼	99½	825	832½	790	794
13	425	426	414	415	121	121¼	118½	118¾	102	102¼	99	99¼	827½	832½	796	797½
14	423	423½	413	413½	120	120¼	118	118¼	102¾	103	99	99¾	825	827½	790	792½
15	428	429	417½	418	120	120¼	118½	118¾	103	103¼	99½	99¾	822½	825	792½	795
16	426	427	416	417	120¾	121¼	119¼	119¾	102¾	103	99¼	99¾	815	820	787½	788½
19	436	437	424½	425	122	123	120	120¾	103	103¼	100	100¼	800	802½	780	781
20	430	430½	420	420½	122	122½	119½	120	102¼	102½	99¼	99½	797½	800	780	781
21	425	425½	416½	417	121	121½	119	119¼	101¼	101½	98¾	99¼	793	794	780½	781
22	417	418	411	411½	120½	120¾	118¼	118½	100½	100¾	98¼	98½	763	764	757½	759
23	412	413	408½	409	119¾	120	118¼	118½	100¼	100½	98	98½	764	766	759	760
26	396	396½	395	395½	119¼	119½	117¾	118	99¾	99½	97¼	97½	757½	762½	755	757½
27	389	391	385	386	118½	118¾	117¼	117½	98	98¼	96¼	96½	765	767½	762	763
28	394½	395	389½	390	119	119¼	118	118¼	98¾	99	97¼	97½	779	780	770	772½
29	396½	397	393	394	119¼	119½	118¼	118½	99	99¼	97½	97¾	777½	780	770	772
30	Holiday															
Av'g's	£419.583		£410.381		£121.125		£118.696		£101.560		£98.696		£805.536		£780.429	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted.

MISCELLANEOUS METALS

March 29, 1956

Aluminum ingot, 99 plus % lb			24.4¢
Antimony, spot, lb, less than carload, in cases			36.47¢
In bulk, carload lots, f.o.b. Laredo			33.00¢
Bismuth, ton lots, lb			$2.25
Cadmium, commercial sticks, delivered, lb			$1.70
Calcium, lb, ton lots, 98%, cast			$2.05
Chromium, 97% grade, lb, contract			$1.25
Cobalt, 97 to 99%, per lb			$2.60
Germanium, per gram, 10,000 gram lots	44½¢	@	48½¢
Indium, troy oz			$2.25
Lithium, lb, 98%	$11.00	●	$14.00
Nickel, cathodes, lb, f.o.b. Port Colborne (a)			64½¢
Magnesium, 99.8%, carloads, lb, producer's plants, Freeport, Texas			32½¢
Palladium, troy oz	$23.00	@	$24.00
Platinum (wholesale lots) troy oz	$97	@	$110
Quicksilver, flask of 76 lb, 25 flasks or more	$257	@	$260
Selenium, 99 plus %, lb. (Feb. 1)			$13.50
Silicon, minimum 97%, carloads, lb			20½¢
Tellurium, lb	$1.50	●	$1.75
Thallium, 100 lb or more, lb			$12.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb			(b)$3.45

(a)Includes U. S. duty. (b)Effective Nov. 23, 1955.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	$36.00	@	$37.00
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$23.50	●	$24.50
48% Cr_2O_3 3 to 1 ratio	$44.00	●	$53.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer			$11.25
Mesabi bessemer			$11.10
Mesabi, non-bessemer			$10.95
Lead (Galena), 80%, Joplin, Mo., ton			$201.32

Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties $1.25 @ $1.30 c.i.f. U. S. ports, duty extra, nominal. Long-term contract nominal.

Molybdenum Ore, 90%, per lb of Mo f.o.b. mines	$1.10	@	$1.15
Columbium-Tantalum, per lb, combined oxides	(a)$1.35	@	$1.50
Tungsten Ore, per unit of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra	$33.25	●	$33.75
Domestic, scheelite, 60% f.o.b. mill			$63.00
Vanadium Ore, per lb of contained V_2O_5 f.o.b. mines			31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton			$84.00

(a) Nominal.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb, in bbl carload lots delivered			5½¢
Cobalt Oxide, 72½% to 73½%, ceramic grade, per lb	$1.96	@	$1.98½
Copper Sulphate, 100 lb			$16.70
Germanium Oxide, gram			27½¢
Molybdic trioxide, technical, per lb of Mo	$1.30	●	$1.33

ALLOYS

Ferrochrome 65 to 70%, per lb of Cr. (4-9% C)			26¼¢
Ferromanganese, 74 to 76%, per lb., shipg. pt	10.25c	@	10.75c
Ferromolybdenum, 55 to 65% Mo, lb of Mo contained	$1.54	@	$1.66
Ferrosilicon, 50% per lb of Si f.o.b. shipping point			12¾¢
Ferrotungsten, 72 to 82%, lb of W contained (eff. Feb. 1)			$3.45
Ferrovanadium, per lb of V delivered	$3.10	@	$3.45
Silicomanganese, max. 1½% carbon, lb, contracts			12c
Spiegeleisen, per long ton, 19 @ 21% grade			$94.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds) ton:			
Crude No. 1	$1,400	@	$1,725
Crude No. 2	$750	@	$1,100
Spinning fibers	$350	@	$650
Shingle fibers	$190	@	$210
Paper stock	$114	@	$137
Waste	$82	@	$84
Shorts	$28	@	$75
Asbestos, f.o.b. ,Vancouver, B. C. (U. S. funds) :			
Spinning fiber	$460	@	750
Shingle fiber,, effective Jan. 1	$205	@	$300
Asbestos, Vermont, f.o.b. Hyde Park:			
Spinning fibers	$353	●	$383
Shingle stock	$172	●	$190
Paper stock	$114	●	$145
Waste, stucco or plaster			$82
Refuse or Shorts	$39	●	$72
Barytes f.o.b. cars:			
Georgia, crude, per ton			$18
Missouri, 94% $BaSO_4$, per short ton			$16
Bauxite, long ton, f.o.b. point of shipment:			
Domestic crude, 50 to 52% (not dried)	(a)$5.00	@	$5.50
Domestic, chemical, 55 to 58%	(a)$8.50	@	$9.05
Domestic, abrasive, 80 to 84%	(a)$18.00	●	$18.50
Feldspar, bulk ton:			
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50	@	$22.25
Glass feldspar, white, 20 mesh	$11.75	@	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$33	@	$35
60% effective CaF_2	$28	@	$30
Acid 97% concentrate, bulk, ton			$47.50
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00	●	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$40.00

Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb according to size and quality. Sheet clear, 1½ x 2-inch, 70¢ to $1.10; 2 x 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60@ $2.10.; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton. Scrap $25 and up.

Ocher, Georgia, ton, in sacks	$26.50	●	$30.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports			Not quoted
Sulphur, prime, Texas, mines, long ton			$26.50
Talc, f.o.b. works, ton:			
New York, purified	$18.50	●	$20.00
Vermont, extra white			$12.50
Tripoli, Missouri, ton:			
40-mesh, cream colored			$50.00

(a) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces			$58.50
Steel f.o.b. Pittsburgh, billets, net ton			$68.50
Structural shapes, Pa., Ala. etc., 100 lb	$4.50	●	$4.60

Greater Expansion Seen in Reports

BRIEF REVIEWS of some of the annual reports received by *E&MJ* this year show more and more expansion plans for coming years and greater emphasis on diversification by companies which formerly were in one aspect of the industry, or in only one geographical area.

More summaries of company annual reports, many of which contain information not previously made known to the public press, will be published in next months' issue of *E&MJ*.

American Smelting & Refining Co. net income for 1955 was $33,529,094. In the year, $9,631,000 was expended to develop Black Lake Asbestos and for zinc plant expansion. Construction of dredging facilities at Black Lake were completed and 6-million cu yd silt was removed. Mill construction will begin this spring. First ore will be in the mill sometime in 1958. Full scale production will yield about 100,000 tons asbestos per year.

At Corpus Christi, Special High Grade production was increased to 100,000 tons per year when work was undertaken to double fuming plant capacity. At Perth Amboy a new electric melting and copper casting plant was started. Castings will be cakes of high quality copper up to 13-ft long and weighing up to 3 tons. Also at Perth Amboy, the continuous casting plant is now producing copper tubing with up to 9-in diameter.

Silver Bell Mine, Tucson, Arizona had its first full year of operation and output was 21,000 tons copper concentrate. Construction was started to add molybdenum concentration plant to present mill. Ground Hog Mine, Vanadium, N. M. and Deming Mill at Deming resumed operations on lead-zinc ore. Keystone Mine, Crested Butte, Colo. also started up again.

AS&R and Resurrection Mining Co. entered into joint venture to explore and develop properties held by both companies near Leadville, Colo.

Modest exploration program was continued at Rosario, Mexico, while decision as to mill and surface plant was awaited. Concepcion del Oro Mine, Zacatecas was placed in operation. Options on several fluorspar properties were taken in Paila District, Coahuila.

AS&R owns 52% of Mount Isa Mines Ltd., Australia; reported that exploration and development had increased ore reserves there.

Southern Peru Copper Co. venture with Cerro, Newmont and Phelps Dodge will require the removal of some 120-million tons overburden before open pit mining can begin. AS&R owns 57¾%.

Federated Metals Division of the company expanded by starting a new plant at Toronto and one other in Montreal. A nickel salt unit was in operation at Perth Amboy and the electroplating salts are being marketed by Federated.

During the year the research group came up with a process for the recovery of selenium metal from scrap material.

Cerro de Pasco Corp. consolidated net income was $9,335,269, according to a preliminary report just released; more than double 1954 figure. In 1955 the company acquired the assets of Circle Wire & Cable Corp. and took a two-year option on all the common stock of Compania Minera Rio Blanco, Ltd. Rio Blanco owns a copper deposit in the Andes near Santiago, Chile. Exploration and development program is underway.

Drought in December and January last adversely affected hydroelectric generation in Peru and resulted in some curtailment of the company's refined metal production. As a result substantial quantities of blister were sold in export market. For the most part, mine and smelter production continued on schedule.

International Nickel Co., Inc. annual report shows a net income of $91,566,566 for the year 1955. Metal deliveries amounted to 290,463,934 lb nickel and 263,189,108 lb copper. In addition to these deliveries, Inco delivered 5.9-million lb nickel to GSA. From additional concentrates supplied by Sherritt Gordon (who supplied concentrates for GSA metal), Inco provided industry with an additional 2-million lb nickel. Huntington Works, W. Va. produced 2.5-million lb nickel pig.

By the first of January, the company's new iron ore recovery plant, which cost $19-million, had its first section onstream. This project at Copper Cliff will have 1,000 tpd pyrrhotite feed rate and will yield about 250,000 tons, 68% Fe pellets per year. Process will recover nickel, sulphur and other by-products.

A vacuum melting line was installed at Huntington Works to explore the vacuum melting field.

Inco mined 14,247,000 tons ore (13-million from underground mines) during the past year. Expansion work during the year added 3.5-million tons to present capacity. Creighton mine will be developed at 68 level, 5,425 ft down. Reserves at all mines stand at 262,369,000 short tons, containing almost 8-million tons copper-nickel.

Exploration called for the expenditure of $5,182,000 during 1955. Work at Crean Hill, Sudbury District, demonstrated that a new mine is in the making. Shaft was sunk to 1,242 ft. New mine will be ready in about three years. Exploration shaft at Mystery Lake, Manitoba was down to 1,325 ft. Underground exploration will confirm the sizeable orebody already indicated by surface drilling.

Phelps Dodge Corp. annual report stressed the following facts about the mining and smelting activity of the firm:

The joint venture with Cerro de Pasco, Newmont Mining Co. and American Smelting & Refining Co. to develop the Peruvian copper deposits of Southern Peru Copper Co. will cost P-D 16% of the total $100-million project cost.

Development program at the Lavender open pit was completed during 1955. At 14-15,000 tpd, the project has enough ore to last eight years.

Morenci replaced electric locomotives with thirteen 1750 hp diesel engines. Production from Morenci open pit averaged 158,732 tpd, waste and ore. Ore reserves were increased.

New Cornelia installed two diesel locomotives and twelve 30 cu yd dump cars. Production from Ajo pit going to Cornelia averaged 73,349 tpd, ore and waste.

Total copper production from P-D mines during 1955 was 257,477 tons. Refining operations at Laurel Hill and El Paso produced 403,352 tons copper plus considerable gold, silver and other rare metals. Laurel Hill tank house capacity was being increased by 3,500 tons copper per month and when this increase is onstream, total capacity at Laurel Hill will be 175,000 tons copper per year. Capacity at El Paso was increased by 2,400 tons per month and is now at 290,000 tons copper per year.

Copper Queen produced 546,001 tons ore from underground operations at Bisbee. Development increased ore reserves.

Drilling at Burro Mt., near Tyrone, N. M. continued to be encouraging.

Net income for the year 1955 was announced at $72,319,224.

Kennecott Copper Corp. produced 370,487 tons copper in its domestic division and 156,228 tons in its Chilean division, according to the annual report for 1955. Domestic production can be broken down as follows: Chino, 63,490 tons; Nevada, 27,177 tons; Ray, 48,983; and Utah Copper, 230,837 tons. To produce 370,487 tons at domestic mines, more than 42-million tons of ore were mined and milled. Total production of molybdenum almost reached the 32-million lb mark, while silver production was 3,445,762 oz and gold production 414,444 oz.

Chino completed relocation of mine shops and part of Santa Rita town and made some 33-million tons ore available for mining. Chino and Ray are experiencing some difficulty in recovery of non-sulphide in ore. Facilities are being installed to treat copper now being lost.

Veteran pit at Nevada Mines division went into full production last August. Hi-Minnesota orebody will be ready for mining this year. Improvements in

crusher facilities are being studied as a means of combatting drop in grade and rise in refractory nature of ore at Kimbley and Veteran pits.

Ray discontinued underground operation in January 1955 and all production is now by open pit. Leaching of the caved areas of old underground workings is in progress and 7,546 tons cement copper were produced last year.

To maintain capacity at Utah Copper, stripping ratio of 1.65 tons waste to 1 ton ore had to be established. Four additional 125-ton electric locomotives were put into service. Twenty-two of the 50 forty-ton dump cars ordered have arrived. To expand the mining area, the entire electrical distribution system has to be altered. Job will be completed by year's end. Construction on company's large vertical cast-shapes unit has been completed.

Braden Copper Co. in Chile had labor difficulties and occasional lack of water, but still managed to increase its 1955 output some 44% over 1954 figure.

Kennecott's exploration activities included remapping of all four domestic properties in the search for new ore; checking out copper deposits near Glacier Peak, Washington, Arctic Sea area of Canada, New Brunswick near two important lead and zinc deposits. Kennecott is looking for columbium and has acquired one such deposit at Odegi, Nigeria. Kennecott and Molybdenum Corp. of America plan to investigate Oka columbium deposit.

In the metal fabricating field, Chase Brass and Copper, Kennecott subsidiary, had been working on titanium (pilot plant scale), rhenium, columbium and zirconium.

(Annual Reports continued p 198)

Australia Will Sell Uranium to Britain

UNITED KINGDOM's Atomic Energy Commission has agreed to purchase more than $90-million worth of uranium oxide from the Mary Kathleen uranium leases near Mount Isa, northern Queensland, over a period of seven or eight years.

Federal Supply Minister Howard Beale said in Canberra that a $22.5-million treatment plant would be built at the site and output would begin in 1959. U. K. will lend up to $14-million to bring the Mary Kathleen field into production, with the balance provided by Rio Tinto Co., the British investment concern, which will develop the area.

The British AEC also will buy a further $45-million worth in the same 7 to 8-year period if Australian mines can produce it.

Prof. C. N. Watson-Munro, chief scientist of the Australian AEC, says atomic energy will be available to Australian industry at competitive prices within 5 to 20 years.

(Mining News continued p 122)

As we went to press . . . .

National Lead Co. assumed operation of the AEC's uranium processing mill at Monticello, San Juan County, Utah, April 1, following execution of an agreement with the Government. Galigher Co., former operator of the facility on a fee basis, decided not to seek renewal of its contract after expiration on March 31. Plateau operators show keen interest in operation of the Monticello mill because they feel it often has been used as a yardstick for determining profit margin for private millers.

Texas Co. has obtained option to buy the famous Happy Jack mine (*E&MJ*, March 1956, p 68). Option and contracts in short form have been filed at the San Juan County recorder's office. Texas Co. holds major interests in New-Shat-Tex Corp., which already has a proposal before AEC to build a multi-million dollar mill at Mexican Hat. Other parties in the firm are New Jersey Zinc Co. and Shattuck-Denn Mining Co.

ODM has announced that one-half of its 74 stockpiles of critical materials have been completed. Included in the lists of materials are those which were stockpiled under "minimum" needs and "long-term". Products for which purchasing has been completed include the minerals: crude aluminum oxides, chrysotile asbestos, crocidolite asbestos, Madagascar crystaline flake graphite, graphite other than Madagascar crystaline and Ceylon, rare earths, tantalite and vanadium, Agar aluminum, bauxite (metal grade Surinam type), cadmium, columbite, industrial diamonds, acid-grade fluorspar, lead, battery-grade manganese natural ore, metallurgical grade manganese ore, and mica (Muscovite splittings). Also tin, tungsten.

President Eisenhower refused to raise tariffs on acid-grade fluorspar as recommended by three members of the six-man Tariff Commission. The President gave no reason for his decision. (See above.)

Open pit mine operators are closely watching the progress of HR 9075, a bill which would impose increased taxes on gas, diesel fuel, special motor fuels, tires, trucks, buses and truck trailers. While declared application of the tax is to pay for the Federal highway program, the phrasing of the bill places the tax on "vehicles used on, or suitable for use on, highways." Therefore, says American Mining Congress, "a vehicle suitable for use on the public highways, which may be used off highways . . . would not qualify for the special refunds or credits provided in the bill." Government said the blanket application was necessary because "of the administrative problem in determining extent of use" off the highways.

American Mining Congress has presented to the House Ways and Means Committee, a statement urging rejection of pending bill HR 5550, which would authorize U. S. membership in the Organization for Trade Cooperation (OTC).

U. S. imports of iron ore set a new record in 1955, according to reports by Government sources. 26.3-million net tons came into this country last year, says the report, and 120-million tons were shipped by U. S. mines to steel plants. Last year's import tonnage represented a 48% increase over the 1954 record, says Department of Commerce, and eight times greater than 1946.

Behind the By-Lines...

G. P. Lutjen

How independent is *your* thinking? Do you have what it takes to back your personal judgment against the opinion of the group? We've got some notes on the subject. It seems that Dr. Solomon E. Asch has described experiments at several universities designed to check people's confidence in their personal judgment. We lifted the details from Arthur D. Little, Inc.'s ***Industrial Bulletin.***

"Seven to nine young men compared, by eye, the lengths of vertical black lines drawn on two large white cards—one bearing a standard line, and the other bearing three lines, one of which was identical to the standard. Each subject was asked to report which line on each of several test cards matched the standard. At first, all went well; in the first two comparisons the subjects all agreed. But then, one man (the real subject of the experiment) found himself disagreeing with his colleagues, who by prearrangement had been instructed to give wrong answers. The built-in schism continued; further line-matching measured the subject's ability to resist the pressure of the contrary opinion of the group.

"The experiments were so conducted as to keep the subject from suspecting his position. Sometimes the disagreement was slight; here the subject had to weigh the evidence of his senses very carefully against the opinion of his group. But in any event, the subject had to state his opinion in public, in the face of majority and equally public opinion to the contrary. The position of the majority was frequently the wrong one; out of 18 trials in each series of experiments, the majority gave 12 wrong answers.

"Under these circumstances, the average individual tested lost his self-confidence. Whereas he would normally err less than one per cent of the time in matching the lines, he swung to the position of the majority, and voted wrong 36.8% of the time under group pressure. There was considerable spread, however; about one-quarter of the subjects tested never lost their independent judgment, while conversely, some were never able to break free from the herd.

"To test the effect of the size of the majority, the 'opposition' was varied from one to fifteen persons. With only one contradiction to face, subjects almost always answered correctly, but when the opposition increased to two persons, the 'margin of error' jumped to 13.6% and to 31.8% for three persons. Beyond three persons, there was little additional effect.

"Whenever the subject was provided with a supporting partner, his tendency to err decreased to one-fourth its previous level. But it appeared that if the partner was a 'moderate' dissenter—choosing a line only slightly different from the standard—the subject followed his colleague's opinion; if the partner was an 'extremist' —making grossly erroneous choices—the subject expressed even more freedom in his own opinion."

All right, all you lemmings! Over the cliff!

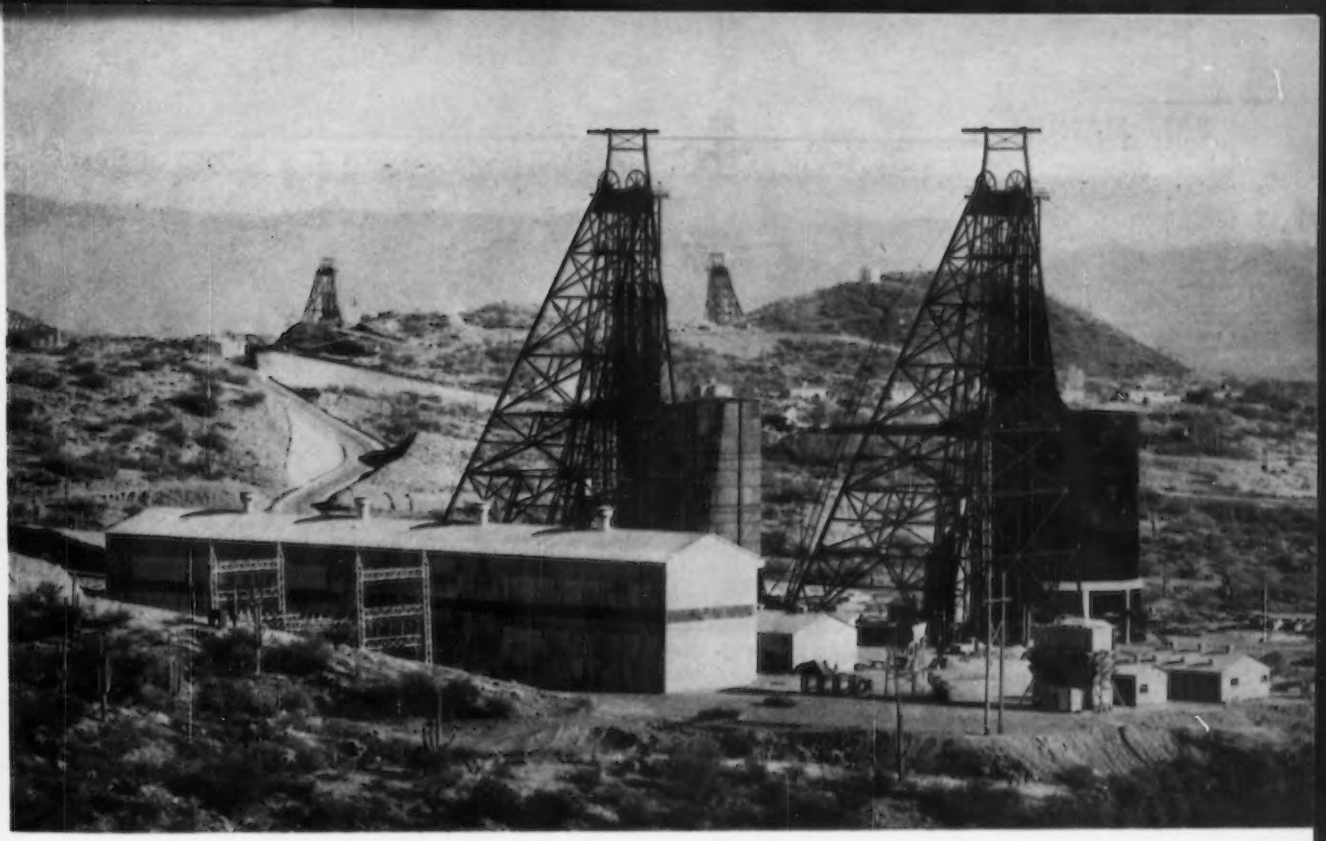
The E&MJ Chowder, Marching and Margaret Sullavan Society met during the February conclave of the AIMMPE in New York when a random sample of fugitives from the technical session ramparts fell back to the Statler bar for regrouping. The president turned on his cap lamp to indicate that a quorum was present and opened the meeting. While the assembled brethren huddled over the mahogany with empty stares and full glasses, the treasurer summed up the Society's assets; 16c in cash, a rain check to the fourth game of the 1938 World Series and an I.O.U. for 30c from a Couer d'Alene geologist. The president entertained a motion that dues be collected, but in view of the strained fiscal conditions, the finance committee ruled that the president should refrain from entertainment of any kind.

Under "New Business" everybody perked up to take a hand in formulating the Society's new policy on mining conventions. After a modest amount of bickering during which the only geophysicist present got completely degaussed, it was decided to recommend unanimously to the AIMMPE and to the Mining Congress that all future mining meetings be held via closed circuit TV in the headquarters hotel. The conscientious conventioneer dons his purple lounging robe, settles down comfortably and tunes in the session he wants. If the speaker doesn't deliver, a turn of the dial puts the viewer at another session. Program quality should climb considerably when this hits home. Program expenses would be defrayed by allowing two minutes out of every 15 for commercials.

As a demonstration of good faith, the Society is offering to sponsor its own Quiz Show, temporarily entitled "The 100,000-Ton Question." The *ad hoc* committee confidently felt that Anaconda or St. Joe or somebody would probably be glad to give away a mine as first prize. Second prize will be a year's supply of interesting assays.

Even now the Society president may be hitchhiking his way to the Mining Congress offices in Washington with this brilliant proposal safely tucked in his bindle.

The 25th Fighter Squadron of the U.S.A.F. has added a technical-type sign to our growing collection. Prominently displayed in the pilots' briefing room is the admonition, "Do not engage the mouth until the brain is in gear."



SAN MANUEL--- America's Newest Large Copper Producer

A. W. KNOERR
Editor

WHEN SAN MANUEL COPPER CORP., wholly owned subsidiary of Magma Copper Co., shipped its first load of copper anodes early in January 1956, that event marked the fruition of one of the largest copper projects to be launched in the U. S. in the past 30 years.

Loan commitments and expenditures thus far required to develop and equip the operation to the production stage will total well over $100-million. Part of this is covered by an RFC loan application approved on July 14, 1952 for $94-million. San Manuel and its parent company have already spent about $32-million on the project.

Because of the skilled teamwork of San Manuel's staff and the various contractors and consultants engaged, the project has been completed about six months ahead of schedule, and costs are expected to be "somewhat less" than estimated for the RFC authorization.

Ore reserves of the San Manuel orebody situated about 46 miles northeast of Tucson, Ariz., are estimated to total about 500-million tons running about 0.8% copper. Production rate will be about 70,000 short tons of copper and 3,000 tons of molybdenum concentrates annually.

Mining will be carried on underground by block-caving at a rate of about 30,000 tpd. A company-owned railroad transfers the ore seven miles to the town of San Manuel where a smelter and a 30,000-ton concentrator are situated. This modern townsite will eventually house about 7,000 people. At full capacity, the operation will require about 1,850 employees.

Copper anodes produced at the smelter are shipped 29 miles on a company-owned railroad to Hayden, Ariz., and thence to a Phelps-Dodge plant for refining.

How America's fourth largest copper producer became a reality is told in the following pages. It took courage, persistence, technical skill, business acumen and venture capital to make a mine out of San Manuel. This is revealed briefly in section on "The Men Who Made San Manuel." Following that, *E&MJ* presents a descriptive account of the mine, mill and smelter. Since it is too early to discuss operating details and results, these elements have been omitted.

Concluding this article, *E&MJ* introduces W. P. Goss, president of Magma Copper Co. and San Manuel Copper Corp., has new staff and others who have contributed generous information for this article, and who deserve the credit for launching San Manuel—America's newest large copper project.

A. J. McNAB, Chairman of the Board of Directors, Magma Copper Co., and San Manuel Copper Corp.

WESLEY P. GOSS, President and General Manager, Magma Copper Co. and San Manuel Copper Corp.

JOHN GUSTAFSON, formerly geologist for Magma Copper Co., who recognized possibilities of the San Manuel prospect.

The Men Who Made San Manuel[1]

HERE ARE THE FACTS on the men and the events instrumental in the growth of the San Manuel copper project from a prospect that nobody wanted in 1942, to a $118-million enterprise in 1952.

History begins in about 1870 when the first claims were staked on Red Hill, the famous outcrop that is San Manuel's sign post. There is no record of much activity there beyond a couple of unproductive holes that were drilled in 1917, until 1925, when Anselino Laguna took over the Red Hill claims.

Before he died a few years later, Laguna took in as his partner, Burns Giffin, who ran a garage in Superior, Ariz. After Laguna's death, Mr. Giffin formed a partnership with James M. Douglas, who ran a saloon, also in Superior. Later, the two of them gave an interest to Victor Erickson, a retired mechanic once employed by Magma, in return for his doing assessment work and building a small camp at Red Hill.

The next few years must have been discouraging, indeed, to the three owners of San Manuel. They made no progress at all, although in 1941 they succeeded in getting Magma Copper Co. to send an engineer down to look at the property. Their asking price at that time was a modest $50,000, but the engineer reported that San Manuel had "no apparent value" and Magma turned them down.

The partners however had a determined belief in the hidden value of their claims that keeps every prospector going when common sense would dictate giving up. Mining would die without that quality.

Next, a Mr. Piffin took an option on San Manuel but finally let it expire along in 1942. In April 1942, the partners decided to get help from some one with more experience in mining, and they went to Henry W. Nichols, an assayer for Magma. He agreed to do what he could to advance San Manuel's interests in return for a share in the venture.

Nichols, as an off-hours job, examined the prospect, wrote a report, located some new claim for the owners, and finally discussed what he had learned with various members of the Magma management. He could arouse no interest.

Early Samples Too Low

Despite this, Nichols believed in San Manuel. He took samples to the AS&R smelter at Hayden, only to learn that the ore was too low in copper and silica and too high in alumina to be of interest to the smelter.

Nichols then thought of the RFC. On October 20, 1942, he sent his own report and an application for a loan of $20,000 to the RFC office in Phoenix. His idea was to finance a series of drill holes that might prove up enough ore to warrant building a mill.

On about Nov. 9, 1942, the Phoenix office sent the papers on to Washington. On about Dec. 5, an RFC engineer from the Phoenix office visited the property. He seemed to like what he saw, but the hopes of the partners were dashed once more when they had word on March 10, 1943 that the RFC had rejected the loan application.

Enter the USBM

A this point, one must back-track to 1939, when the 76th Congress passed Public Law 117, the Strategic Materials Act. Section 7 of that law directed the U. S. Geological Survey and the U. S. Bureau of Mines to explore for new domestic sources of the so-called strategic metals. Copper was not included at that time.

However, by 1942 Washington had become gravely worried over an impending copper shortage. The USGS and the USBM were directed, in July 1942, to add copper to their list of strategic metals, and to hunt vigorously for new copper orebodies.

By the end of 1942, the Bureau had 12 copper exploration projects underway, one of them in the Old Hat district in the Catalina mountains, just south of San Manuel's Red Hill. Thus, the Bureau was ready, willing and able to begin drilling at San Manuel when it was pointed out to them.

The Bureau of Mines' staff believes

[1]This historical section on the San Manuel project was prepared by Robert H. Ramsey, former editor of *Engineering & Mining Journal*.

OLD. Churn drills probe for ore in 1947 near the present site of the No. 2 Shaft. Note Red Hill in the background.

NEW. Twin 3A and 3B ore shafts, each driven by two 3,000-hp motors signal the start of copper ore production.

Highlights in the Growth of San Manuel

1870—First claims staked at Red Hill near Oracle, Ariz.
1917—Two holes drilled on claims, missed orebody.
Feb. 1941—Three partners offer San Manuel to Magma Copper Co. for $50,000. Offer rejected.
April 1942—Partners seek help of H. W. Nichols, Magma assayer.
July 1942—USGS and USBM begin intensive search for copper.
Oct. 1942—Nichols applies for $20,000 RFC loan on San Manuel.
March 1943—RFC rejects Nichols' loan application.
March 1943—USGS examines San Manuel, refers it to USBM.
May-July 1943—Partners offer San Manuel to various people. No takers.
Aug. 1943—USBM concludes agreement to drill San Manuel.
March 1944—Reports of USBM's ore discoveries at San Manuel reach Magma. No interest shown.
April 1944—John Gustafson, geologist, reaches Magma.
May 1944—Gustafson hears reference to San Manuel.
June 1944—Recommends buying San Manuel.
June-July 1944—Partners approach other companies.
Aug. 1944—Gustafson writes detailed report, asks approval option agreement terms.
Aug. 1944—Option agreement signed.
July 14, 1952—RFC approves $94-million loan application.
Jan. 1952—Major mine development starts.
May 1953—Construction of San Manuel—townsite, mill and smelter starts.
Jan. 1956—First shipment of copper anodes.

that the RFC, although they rejected the San Manuel loan, did refer the property to the USGS. Nichols, himself, believes that Lynn Hersey, who was then assistant chief of the primary production branch of the copper division of the WPB, suggested San Manuel to the USGS as a copper prospect they might include in their exploration program. At any rate, the USGS examined San Manuel and suggested that the Bureau drill it. By August 11, 1943, agreements had been signed with San Manuel's owners giving the Bureau the right to drill and explore the property for minerals. At no time, however, did the owners stop trying to sell San Manuel.

They offered it to Kamp & Co., Denver, Colo. on May 5, 1943. On May 11, 1948, they offered it to a Mr. Harding, of Nogales, and on July 10, 1943, to a Mr. Olsen of Denver. On July 22, 1943, they offered San Manuel to the neighboring St. Anthony Mining & Development Co. All these offers were fruitless.

Drilling Proves Ore

The Bureau began drilling at San Manuel on Nov. 23, 1943. The work was directed by Charles A. Kumke, a Bureau engineer. By Jan. 13, 1944, they had put down five shallow churn drill holes totaling 1,480 ft. The re-

sults showed only that oxidized copper mineralization existed to at least 350 ft, but that character and grade of ore were unsatisfactory.

Deciding to carry on and probe for sulphide ore below the oxidized mineralization, the Bureau put its holes on down to a 2,000-ft depth and extended drilling over a wider area. When this second phase was completed by February 1945, footage drilled totaled 15,844 ft, and the Bureau considered that it had indicated 30-million tons of ore averaging 0.8% copper. Half this ore was oxidized, and of that half, most of it carried chrysocolla (copper silicate) as the chief copper mineral. But the drilling did show that beneath the oxidized ore was sulphide ore fully up to the average grade.

Interest Aroused

When the Bureau's drills began to cut a real orebody in the spring of 1944, the word inevitably got around the neighborhood. In fact, one of the San Manuel owners told the Magma mine superintendent at that time that the Bureau had 1,000 ft of 1% ore in a churn drill hole near Red Hill.

Spurred by the Bureau's discoveries, the partners were now pushing the property in earnest. In order to permit full disclosure of the Bureau's drilling results, the partners had to write a letter to the Bureau asking that such information be released to each individual whom they wished to receive it.

On about July 1, 1944, Nichols and his partners approached the American Smelting & Refining Co. and Goldfields American Development Co. They also wrote letters to the Bureau requesting that AS&R (on June 13, 1944), Anaconda Copper Mining Co. (on Aug. 10, 1944), and Magma Copper Co. (on Nov. 10, 1944) be allowed to send representatives to the property and to receive all permissible information concerning it.

Action Begins

Magma was fortunate at this point to have two men on its staff: John Gustafson, geologist, who had been hired to locate more ore in the aging Magma mine at Superior; and Wesley Goss, who had come to Superior a month or two previously and had become manager on July 1, 1944.

When Gustafson reached Superior in April 1944, he set about carrying out his twofold instructions to study Magma's ore problem and improve its water supply position. One afternoon in May, Gustafson was working over a geological map in the engineering office when he overheard a snatch of conversation from the hall outside the room.

"What's this about the Bureau hitting an orebody down at Nick's claim?" said someone.

"Sure did", was the reply. "They've got one deep hole, maybe more, that runs 1.0% or better."

Gustafson put down his pencil and went into the manager's office.

"Who's Nick?" he asked. "Somebody said he has a claim around here and the Bureau's drilling it."

"He Calls It San Manuel"

"That's Henry Nichols," said the manager. "He's an assayer here. He's had a claim down near Oracle for years. Calls it the San Manuel."

That was the first time Gustafson had ever heard of the property, but that mention of a deep hole in 1% ore riveted his attention. He went through the Magma files to see what he could find on San Manuel and came up with the negative report on the property made in 1941. He read through it, but it didn't convince him. He went over to see Nichols.

He found Nichols in no mood to discuss San Manuel again with anyone from Magma. Magma had had its chance, and he was tired of telling them about it.

In time, Nichols thawed out enough to take Gustafson down to see the property. On June 13, 1944, they walked over the claims at Red Hill, and Nichols told Gustafson about the report he had sent the RFC. Although Nichols didn't know the grade officially, he had an idea that among the Bureau's six drill holes were some that were in copper primary ore for considerable depth.

Gustafson got home that night quite excited. He told his wife that he had just examined one of the best raw prospects he'd ever seen. Next day, he wrote an amazingly detailed report on the property.

He said flatly that Magma ought to buy San Manuel, the sooner the better. He knew that other companies might be down after the property at any minute. While waiting a reply, on his own initiative he talked over terms of a possible option agreement with Nichols and his partners.

By July, the partners were ready to work out a deal with Magma, but, as already noted, they approached other mining companies, too.

Gustafson then obtained permission to make a thorough examination of the San Manuel property. On Aug. 25, 1944, he submitted a detailed report, summarizing the existing situation, and discussing the various steps that should be taken to determine further the size of the orebody. He outlined, too, the various problems that would arise if San Manuel were to be developed as a commercial enterprise.

Parenthetically, it is worth noting that along with all this, Gustafson completed his water supply work by Aug. 12, 1944. His final report on possible extensions of the Magma mine's orebodies was written in Feb. 1, 1945. He remained in Magma's employ until July 31, 1945.

To speed things up, Gustafson also telephoned Mr. McNab in New York to give him the details of the option agreement worked out in conversations with the partners and Mr. Goss. Mr. McNab approved the terms over the phone and the option agreement was signed on Aug. 31, 1944. Under the terms of the agreement, Magma began its churn drilling program at San Manuel on Dec. 1, 1944.

Record in Brief

To summarize the record, the commercial possibilities of the San Manuel prospect were discovered by the exploration program which the USGS and the USBM started in 1939 and which they extended to copper in July 1942.

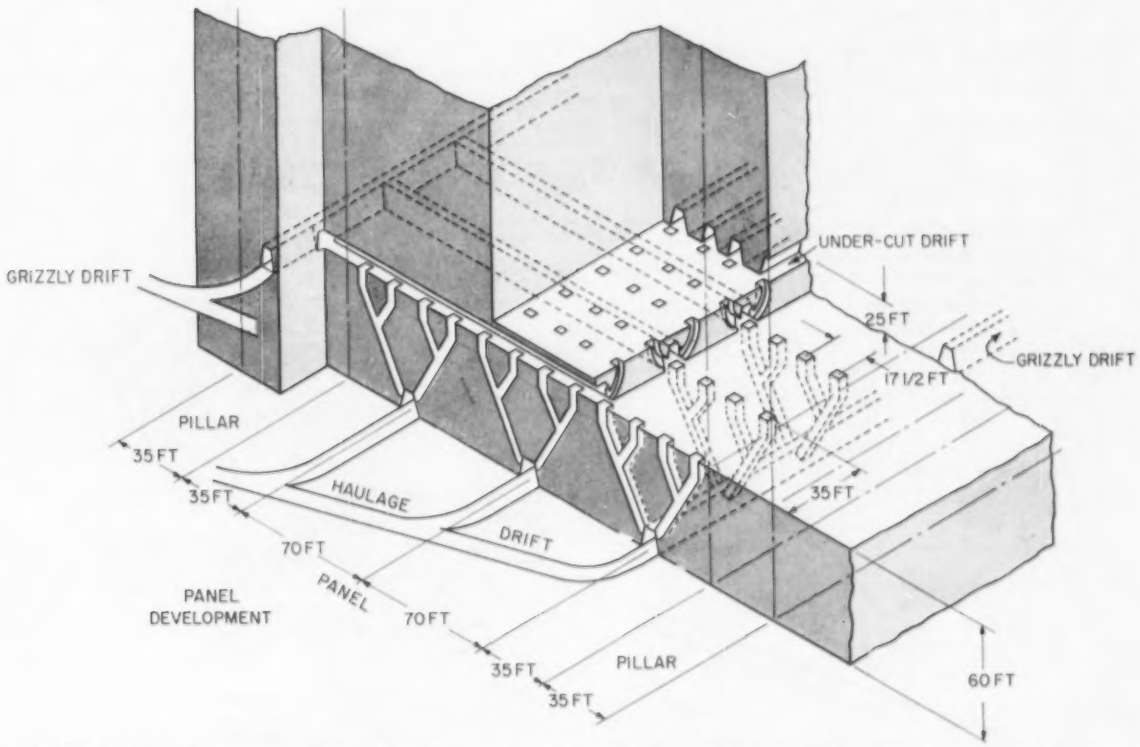
The Bureau's drilling at San Manuel did not disclose interesting possibilities until the winter of 1943-44. Magma Copper Co. had no interest in the property until the summer of 1944, when, along with other companies, its interest was aroused. By moving quickly, it secured an option to purchase on Aug. 31, 1944.

During all this time, the owners of the property had tried steadily to sell the prospect or to interest someone in drilling it.

Before exercising its option on Sept. 17, 1945, Magma drilled 24 holes aggregating 24,096 ft. By the time the drilling was completed in February 1948, they had spent over $2.5-million on the project.

The one new ingredient that San Manuel brought into being was the active, and eminently successful, participation of a Government agency in long-shot exploration for minerals. It will be used ever more widely in the future. We can only hope it will always be used as fairly and effectively as it was used in developing San Manuel.

A View of the Orebody



CAVING BLOCKS such as this are being developed in the vertical part of the orebody near No. 2 Shaft shown below.

How the Orebody Is Being Developed and Mined

THE SAN MANUEL OREBODY[1] is a complex mineralized quartz monzonite and monzonite porphyry containing copper, molybdenite, gold and silver. It consists of two distinct types of ore, sulphide ore and oxidized ore which overlies a portion of the sulphide orebody. A partially oxidized zone has also been recognized over part of the orebody. An irregular fault plane separates the orebody and monzonite from the overlying Gila conglomerate.

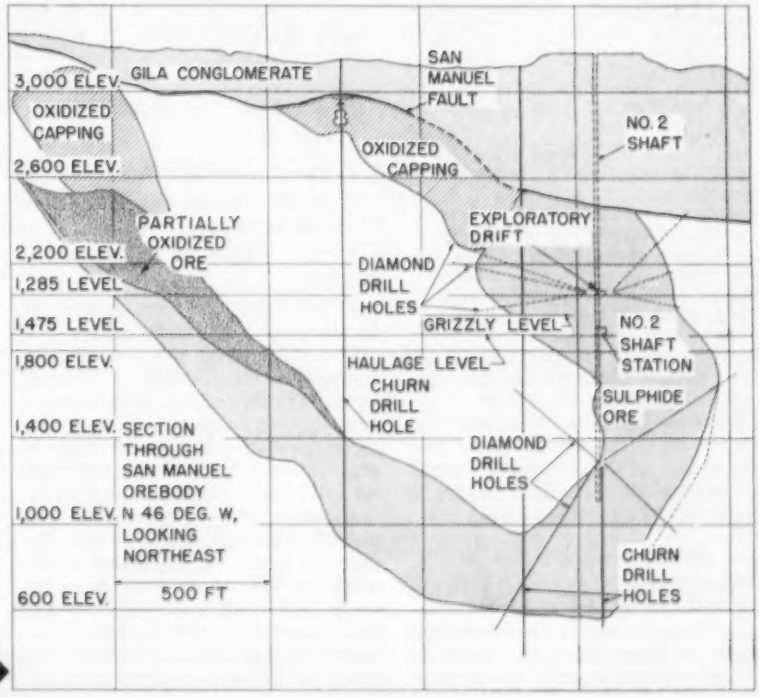
Estimates of proven ore reserves are as follows:

Type of Ore	Tons	Copper content %
Sulphide	367,624,000	0.785
Oxidized	111,876,000	0.717*
Total	479,500,000	0.769**

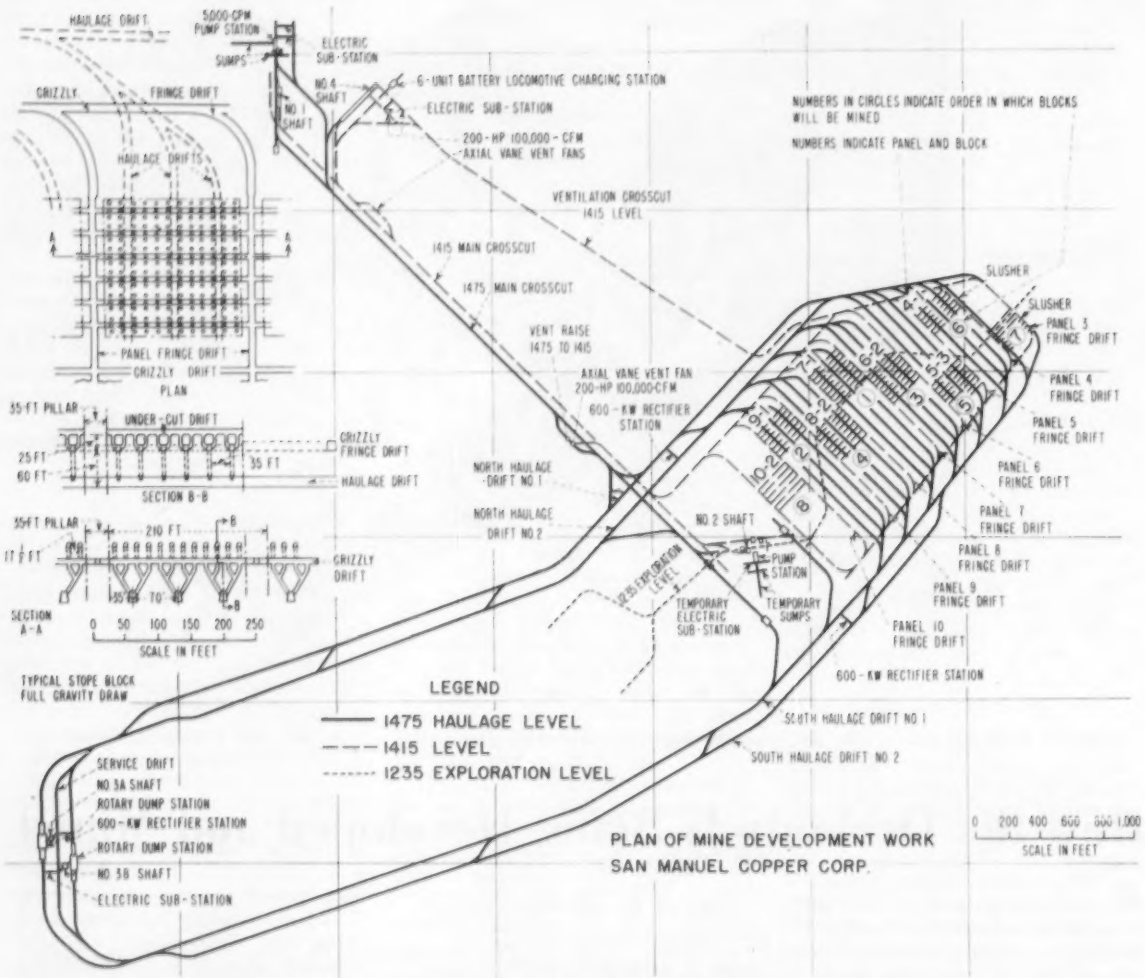
*0.219% sulphide, and 0.498% oxide.
**Average grade.

Mineral content is classified as follows:
Oxidized zone: Chyrosocolla, chief min-

1 Based on the Magma Copper Co. prospectus, Nov. 26, 1952, and other published reports on San Manuel.



SECTION THROUGH OREBODY showing sulphide and oxidized ore zones.



MINE PLAN shows main working levels, caving blocks, and location of major haulage lines and equipment stations.

eral; cuprite in spots; malachite and azurite, rare.

Secondary zone: Chalcocite chief mineral; primary chalcocite with intergrowths of secondary chalcocite, and secondary minerals; some bornite and covellite.

Primary zone: Chalcopyrite, chief mineral; chalcocite, minor.

Sulphide minerals are well distributed throughout the monzonite. They also occur in veinlets. Chalcocite and chalcopyrite are often found as films on pyrite.

For mine planning, the deposit has been divided into the Southeast orebody where mining is currently going on, and the North orebody which is capped by an extensive oxidized zone.

Developing the Mine

After churn drilling had revealed the huge orebody at San Manuel, several important questions had to be answered before development plans could be drawn up. These were:

1. Can the orebody be drained?

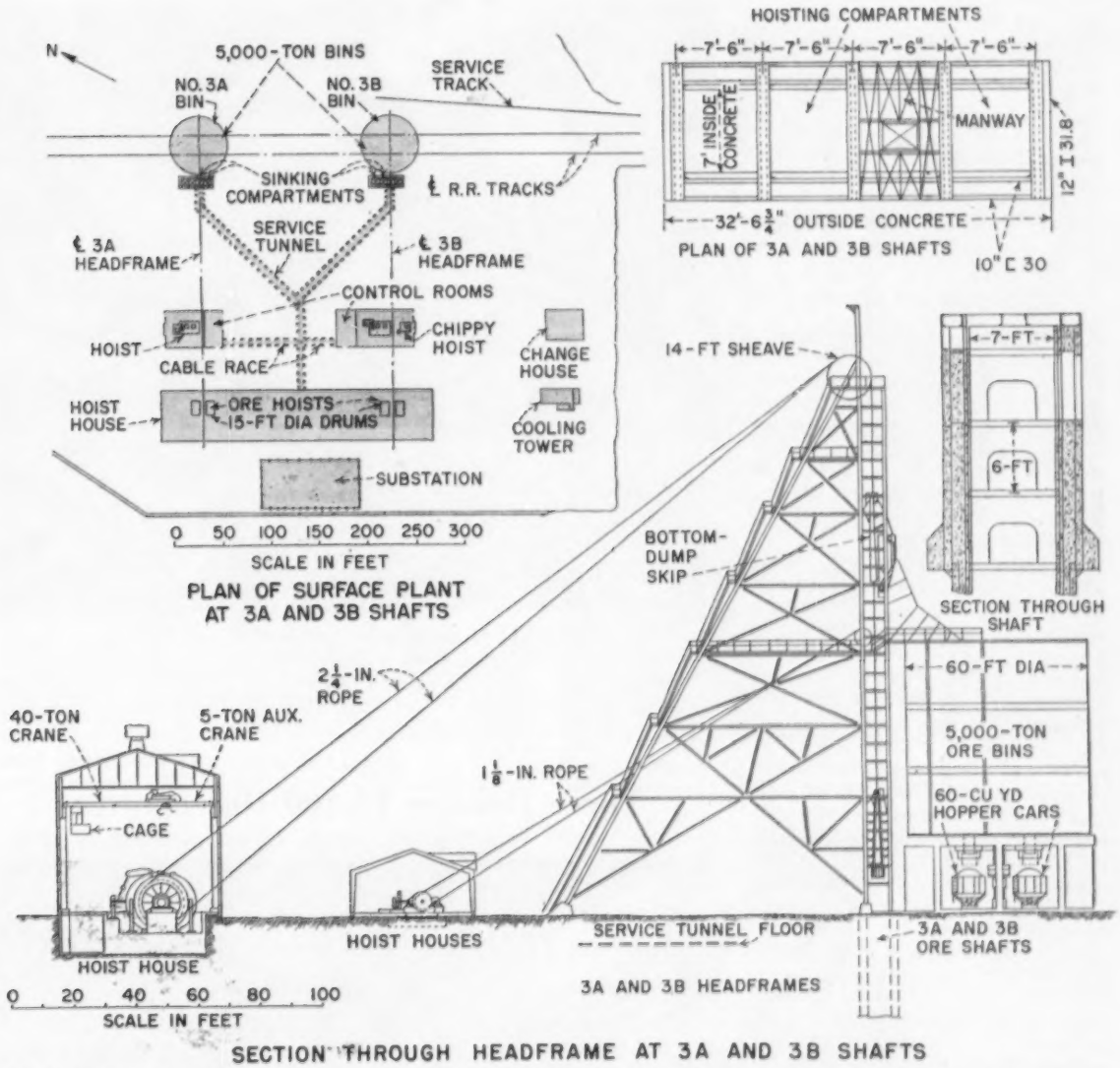
2. Is the orebody such that it can be mined by caving?

3. How reliable are the churn-drill samples?

4. How will the ore respond to metallurgical treatment?

This information was obtained by sinking the No. 2 shaft in a thick section of the orebody with no oxidized capping, and by driving a zigzag exploration drift through the orebody on the 1235 level. Even through the quantity of water pumped at the start was large, observations showed that this would diminish and that the orebody could be drained. Heavy timbering was required to hold up the ground—thus indicating that the ground could be caved readily. Diamond drilling confirmed churn-drill data, and showed that the orebody was remarkably uniform in grade and in mineralogical composition. Large bulk samples were available for metallurgical tests which showed that the ore was amenable to concentration. With these questions answered, the mine was ready for more extensive development.

Accompanying plans, sections and block diagrams show how the San Manuel orebody is being developed. Note that the 1475 level is the main haulage and development level, connecting the caving area with the ore and supply shafts. Sixty feet above this, the 1415 level has been established to develop grizzlies and establish ventilation courses. A series of panels 210-ft wide has been laid out across the long axis of the orebody. Caving blocks contained within these panels measure 210x270 ft. The long dimension may be varied if smaller



EACH OF THE TWIN ORE HOISTS for the 3A and 3B shafts at San Manuel is powered by two 3,000-hp dc electric motors.

blocks become advisable. The presently planned sequence of mining the blocks is indicated on the plan of the mine workings.

Development of a block starts with the driving of panel haulage drifts beneath the blocks along with raise stations. Track consisting of 70-lb rail, ties and ballast is placed in permanent position. Raise crews then move in and install temporary joker chutes at the raise stations. The raise consists of a main raise and a backover driven from a junction below the grizzly level. The main raise and backover are driven to 2 ft above the grizzly level. Cribbing installed in these raises is armored on the upper side with 3x4x⅜-in. angle iron. A manway is installed as soon as the junction set is reached. Then the temporary joker chute is torn out and replaced by a permanent steel chute with air-powered gate.

Next grizzly crews start driving off panel drifts, timbering with 10x10-in. and 12x12-in. timber as they advance. In other blocks steel sets are being used instead of timber to obtain comparative maintenance costs. As the grizzly crews advance, they place draw sets and timber up sections of draw raises. Permanent air and water pipelines are installed as well as sprays and blasting lines.

Crews then drive the draw raises 1 to 2 ft above the floor of the undercut level. The stope is now ready for undercutting the overlying block.

First the stope is ringed with a lightly timbered undercut drift. Three to four finger raises on each side of the stope serve as permanent manways and service ways. Drifts are then driven across the tops of the draw raises. These are widened out to 15 ft and backs driven 15 ft above the floor of the undercut. The 15-ft height is required to eliminate support of the block, particularly that offered by swelling, and coning of the broken rock between the draw-raise openings. Pillars remaining between the various raises are then drilled and shot out with electric blasting equipment.

Of the first eight blocks to be developed, six will use the gravity sys-

tem and two are scheduled to use slushers because they lie in irregular end areas of the orebody where slusher transfer of caved rock will be advantageous.

As the staff learns more about the caving characteristics of the ore, spacing of draw raises is varied for better control. The mining plans are flexible enough to revise present methods where necessary.

Development Details

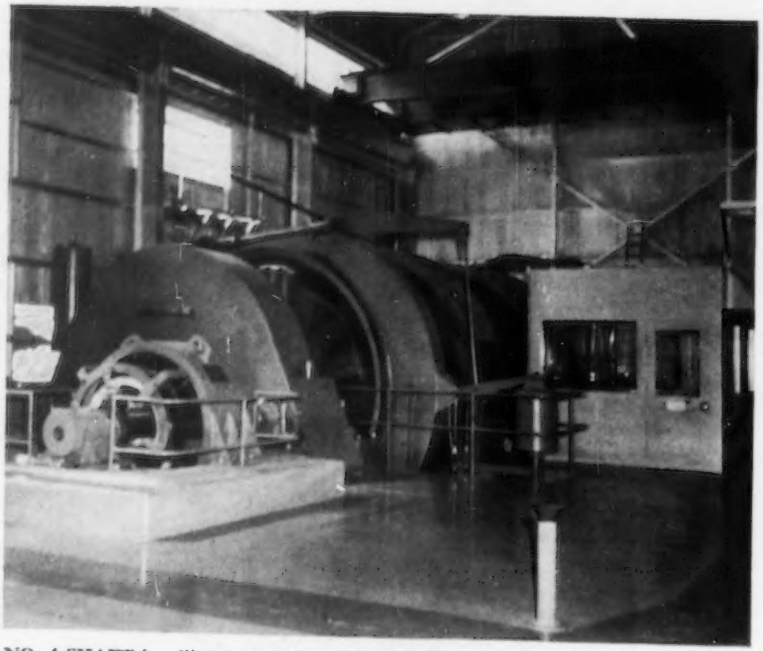
Shaft sinking. Equipment used to sink the new service and ore shafts included 55-lb hand-held jackhammers, throw-away type bits, quarter octagon 1-in. alloy steel, and Riddell muckers equipped with two single-drum 2,500-lb pull air hoists and a ⅜-yd clamshell loading into 1¾-ton buckets. Blasting was done with 40% straight gel and electric detonators.

Normally, steel sets were hung within 10 ft of the bottom. After 8 sets (48 ft) had been installed, concrete was poured starting with the bottom set and proceeding upward to meet the previous lift. Concrete was prepared in a batch plant at the headframe and lowered down through an 8-in. pipeline to a small hopper. A rubber-tired concrete buggy transferred the concrete to the forms. After each concreting cycle, forms were stripped, and guides and pipelines installed. In the 3A and 3B shafts, wooden sinking guides were replaced by steel guides.

Shaft sinking was cycled on 6-ft advances. Drilling 60- to 80-hole rounds required 4 to 6 hr in the 3A and 3B shafts, and mucking time was 4 to 6 hr. Rate of advance of completed shaft averaged about 125 ft per month.

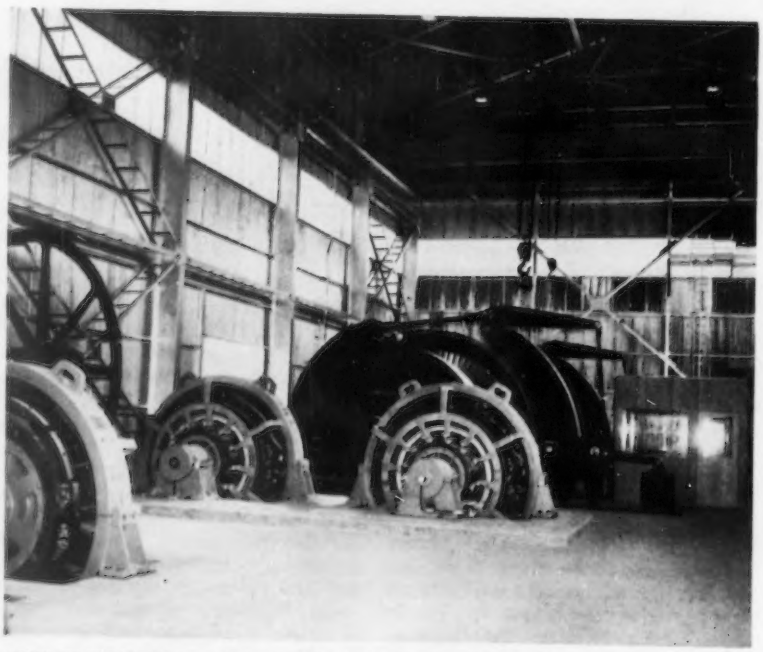
Concrete mix required 6 sacks of cement to the cubic yard. Pozzolith added to the mix gave a early high strength to the poured concrete.

Drifting. Main haulage drifts measuring 10x11 ft were driven with boom-type mechanically powered drill arms carrying 3-in. drifters with 7-ft feed. The booms are mounted on a shop-built car carrying a 1,000-lb counterweight of scrap. No jacks or blocking are required to stabilize the rig. About 32 to 40 holes per round are sufficient to pull a 5½ to 6-ft round. Powder used is 40% straight gel. Electric blasting is used in wet areas. In dry areas, rounds are ignited with thermite connectors and hot-wire lighters for speed and safety. Muck is loaded with overshot-type loaders filling 100-cu ft A-bottom dump cars hauled by an 8-ton battery locomotive. Open ground is supported by 12x12-ft sets



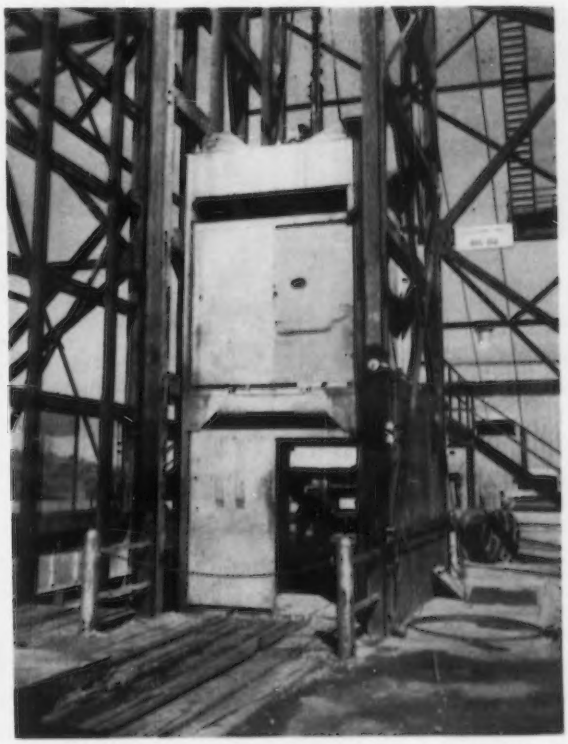
NO. 4 SHAFT handling men and supplies is equipped with a 15-ft diameter double-drum, dual motor with geared clutch. The hoist is powered by two 600 v dc motors deriving current from a 1,750-hp motor-generator set. Rope diameter is 2¼ in. Further details of the No. 4 installation are shown at right.

Three Hoists—13,400 Horsepower



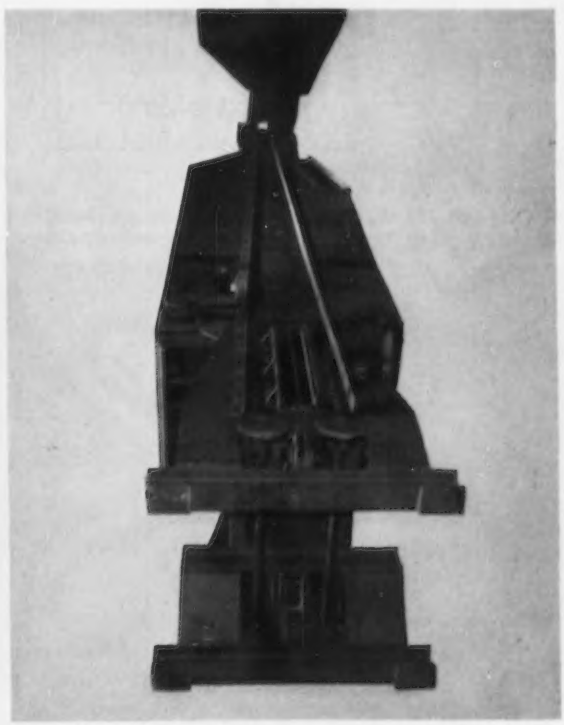
ORE IS HOISTED at the rate of 35,000 tpd through the 3A and 3B shafts, each equipped with a 15-ft diameter double-drum hoist powered by two 3,000-hp motors driven by a 4,000-hp motor-generator set. Rope diameter is 2¼ in. Shaft capacity is 900 tons per hour. Further details about these two shafts are shown at right.

HEADFRAME OF THE NO. 4 service shaft which is completely concreted. Note concrete batching plant at left of shaft.

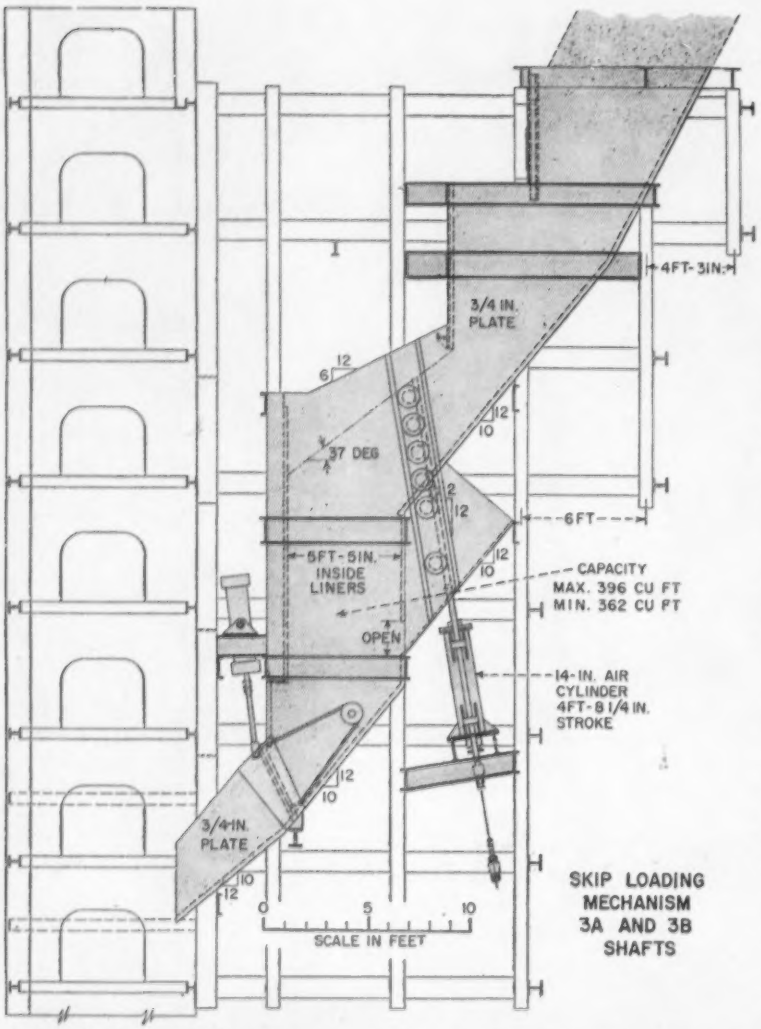


DOUBLE-DECK CAGES of the No. 4 shaft are equipped with rubber-tired guide rollers. Each cage will carry 100 men per trip.

ORE SKIPS at the 3A and 3B shafts dump into 5,000-ton steel ore bins at the headframes. Headframe height is 160 ft.



ORE IS HOISTED in 18-cu ft bottom-dump skips running on all-steel guides. Hoisting speed in the ore shaft is 3,000 fpm.



BOTTOM-DUMP SKIPS with 18-cu ft capacity are loaded in counter-balance at the 3A and 3B shaft loading stations from all-steel air-powered measuring pockets.

SPACIOUS HAULAGE AREAS near the shafts are supported with steel-arch sets.

timbered on 5-ft centers and back-lagged with 3x6's and side lagged with 2x10's.

Haulage — 35,000 tpd

Ore is hauled by 20-ton, 4-wheel trolley locomotives each powered by two 120-hp electric motors. The locomotives are equipped with both dynamic and air brakes. Cars are 13-ton box type of all welded alloy steel mounted on two 4-wheel trucks. New rubber draft gear is used instead of conventional coil types. Each car is fitted with automatic couplers; one stationary, and the other rotary. Fifteen car trains will have a pay load of about 200 tons.

The double-loop haulage system is designed to handle large tonnage (about 35,000 tpd) with one-way traffic. Cars are dumped three at a time at rotary dump stations into 1500-ton ore pockets at the 3A and 3B shaft stations. Haulage grade is 0.44% in favor of the load.

Since the daily haulage load of 35,000 tons is equivalent to about half that hauled each day over the main line of the Southern Pacific railroad, great care was taken to make San Manuel's haulage system rugged and ample. Main haulage drifts are equipped with 90-lb rail mounted on 6x8-in. fir ties treated with Wolman salts. Haulage drifts were driven 1-ft below grade to permit installation of drainage facilities and 12-in. of crushed granite ballast. Haulage drifts in the panels contain 70-lb rail. An estimated 20 miles of development drifts and tunnels have been driven thus far.

Hoisting — 3000 fpm

Ore is hoisted from shaft loading stations in 18-ton bottom-dump skips traveling on steel guides. Ore loaded into skips is measured in baskets controlled by under-cut guillotine-type gates (see illustration). Hoisting speed is 3,000 fpm. Ropes are 2¼-in. preformed. Skips do not run in adjacent compartments, but are separated by a manway. This was done to provide the proper fleet angle.

The 3A and 3B cylindrical double-drum hoists are geared to twin 3,000-hp, 600v dc motors. Drums have a 116-in. face and a 15-ft diameter and will wind 1800 ft of 2¼-in. rope on one layer. Each hoist has its own motor-generator set with flywheel, set for 80% power peak utilization. These m-g units consist of a 4,000-hp, 2300v induction motor driving two 2500-kw dc generators.

Semi-automatic controls enable the skip tender to start the hoisting cycle by push button from the skip loading station underground without the aid of a hoistman.

Men and supplies are transported at the No. 4 shaft equipped with a 15-ft diameter double-drum, dual-motor hoist with geared clutch. Drum face is 90 in., capable of winding 1500 ft of 2¼-in. rope on a single layer. The hoist is powered by two 700-hp, 600v motors. The m-g set consists of a 1750-hp, 2300v induction motor driving two 600-kw dc generators.

Double-deck cages measuring 7x 13½ ft travel 1500 fpm on four 6x8-in. mahogany guides. Cages are equipped with rubber-tired rollers followed by guide shoes. Each cage will handle 100 men, or two 8-ton locomotives.

ORE TRAINS of 35 100-ton bottom-dump cars hauled by modern 125-ton diesel-electric locomotives over 8-mile track are loaded from ore bins at 3A and 3B shafts.

ORE CARS will be dumped four at a time in about 15 sec into this 10,000-ton receiving bin which feeds the 30,000-ton concentrator at the San Manuel plant.

Ventilation — 400,000 cfm

Ventilation plans for San Manuel were based in part on the experience of other mines of comparable size and with similar grizzly drift operations. Air is drawn down the No. 4 and No. 1 shafts and sent through the mine at a rate of about 400,000 cfm. Two 100,000-cfm axial vane fans powered with 200-hp motors are situated near the No. 4 shaft on the 1450 level, a third on the 1415 level in the main crosscut, and the fourth on the 1475 level off the main crosscut (see plan). All air is discharged via the 1475 level after being sent through the grizzly level. Air is exhausted through the 3A and 3B ore shafts.

Fire Prevention System

Because of the large volume of air required, and the timber used in many parts of the mine, heavy emphasis has been placed on fire prevention. If needed, the discharge of the No. 1 pumps can be turned into the water system to supply water at pressures of more than 100 lb to remote sections of the mine. The main piping system has fittings for fire hoses every 300 ft, and hose stations every 1,000 ft.

The ventilation system is flexible so that with the aid of steel fire doors, air flow can be reduced, diverted, stopped or isolated from the various caving panels. This achieves the dual advantage of establishing a fresh-air base near a possible fire area, and checking air supply to the fire area itself.

Three fire-fighting trucks are available underground. These are equipped with fittings, hoses, ladders, nozzles and hand tools for quick action. A stench warning system is installed, and directional signs point the way to all shafts. Shaft collars can be blanked off to prevent air movement if necessary. All electrical equipment installations are supplied with CO_2 extinguishers, and all maintenance shops and pumping stations are either concreted or are fireproofed with gunnite. Transite board is used in some places.

Bosses Enforce Safety

New personnel, shift bosses and supervisors start out at San Manuel with an indoctrination program set up by the safety department. Each shift boss spends two months in the Safety Department, and two shift bosses are working with the Safety Department at all times. The company places heavy emphasis on enforcing and teaching safety through the bosses. All accidents are posted on a blackboard in the mine dry giving name of the man injured, nature and cause of injury, and the shift boss who was in charge at the time.

Two Railroads — 37 Miles

Railroading comprises an important part of the San Manuel investment. Ore moves from the mine to mill over a newly constructed 8-mile standard-gage track. Lime and silica for mill and smelter, and copper anodes are handled over another 29-mile company-owned route. Equipment required to operate these routes includes three 130-ton diesel-electric locomotives, forty-five 100-ton bottom-dump cars, twenty 30-yd lime rock cars. Ore cars are dumped into a 100,000-ton live storage bin at the concentrator. Cars are dumped four at a time. After the compressed air pressure has been built up by the locomotive to actuate hopper gates, these four cars will drop full loads in 12 to 15 sec. Each train consists of forty 100-ton cars. Speed will be about 25 mph. Trips will number nine to ten per day at full capacity.

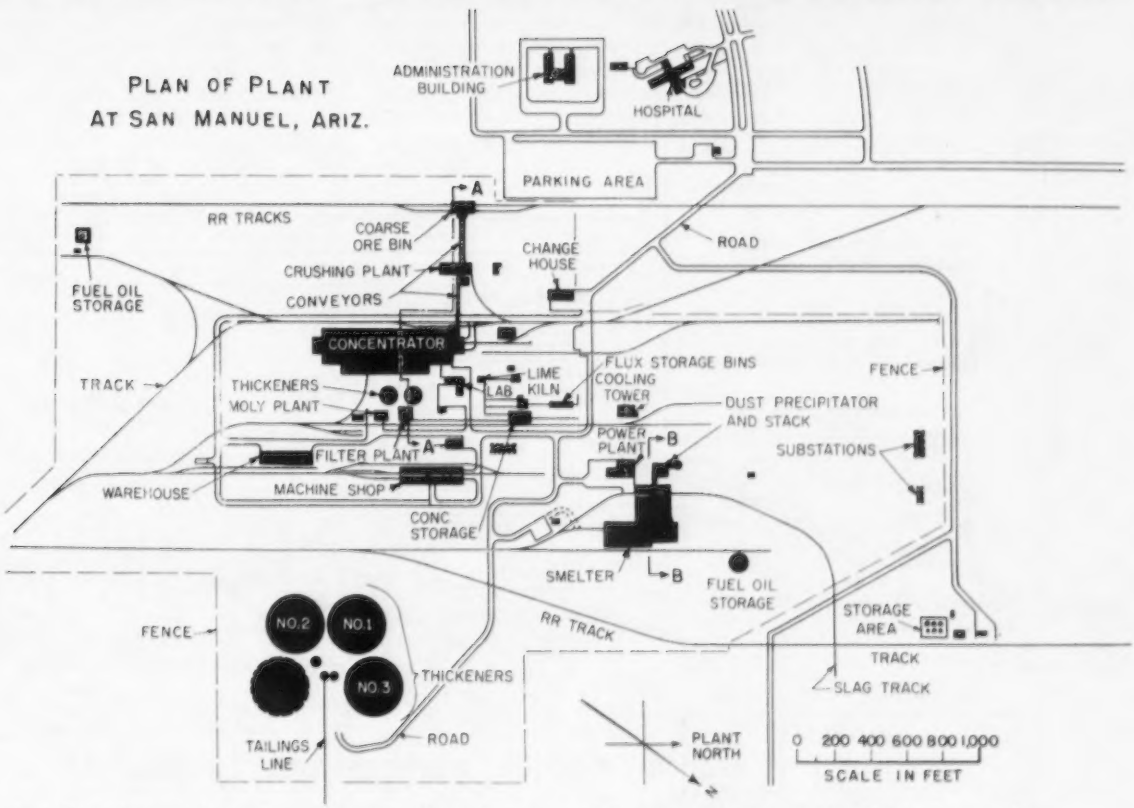
TOWNSITE is shown in the background. Other structures including crushing plant, concentrator, filter plant, molybdenum

San Manuel—A Modern Townsite Housing Mine,

SAN MANUEL'S MODERN TOWNSITE[1] consists of 1,000 dwellings of various sizes to house employees from the mine, mill, smelter and administrative offices. When the project operates at capacity it is expected that 1,850 to 2,000 men will be employed and that the payroll will total approximately $11-million annually.

Three schools serve the needs of elementary and high school students of San Manuel, Mammoth and vicinity. These three schools were com-

[1] Information excerpted from a brochure prepared for celebration of the opening of San Manuel.

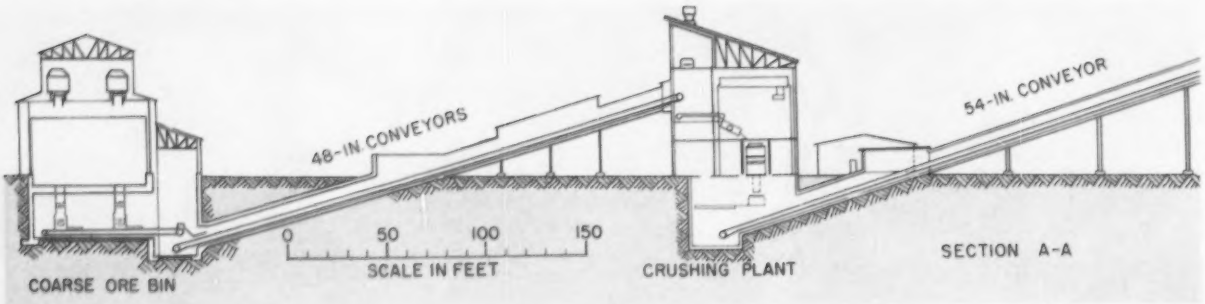


plant, lime plant, smelter, power plant, railroads, and reagent and lime storage tanks, are identified in the map above.

Mill and Smelter Employees

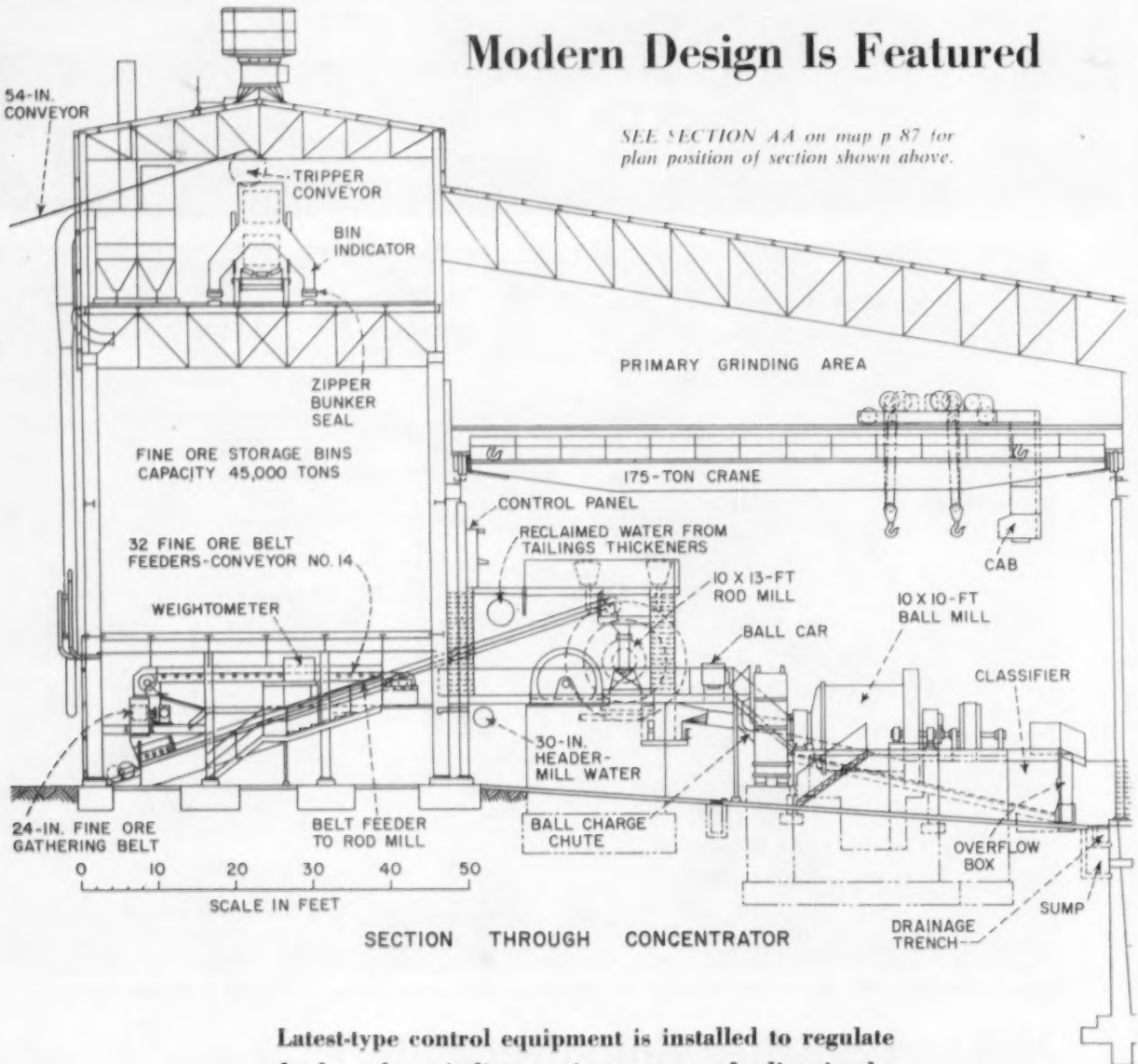
pleted within the past year at a total cost of $870,784 for building and equipment. San Manuel Copper Corp. donated a 40-acre plot for the San Manuel high school, and two 15-acre plots for the elementary schools.

The four-wing hospital is equipped with modern x-ray and operating rooms. It is staffed by a chief surgeon, supervisor of nurses, four doctors, eight nurses and four aides. The townsite also includes an extensive shopping center and parking area, pool and recreational facilities. See following pages for details about the plant.

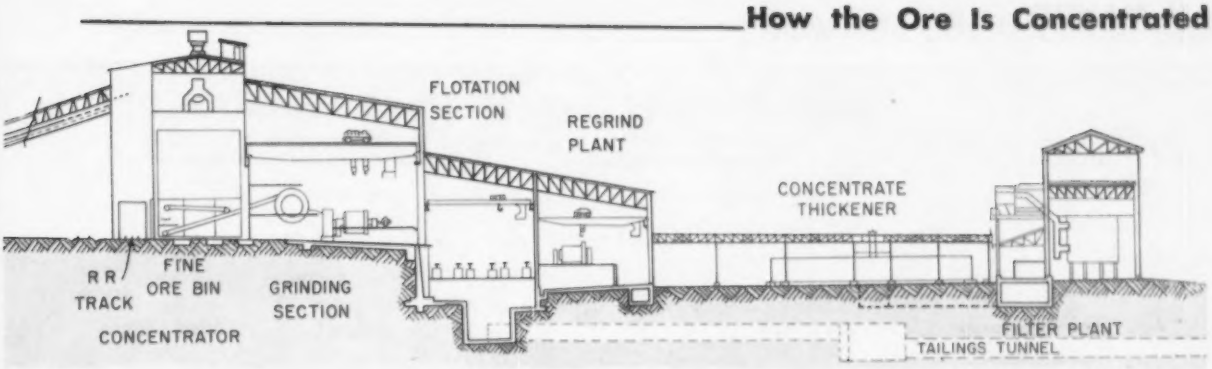


Modern Design Is Featured

SEE SECTION AA on map p 87 for plan position of section shown above.



Latest-type control equipment is installed to regulate feed to the grinding section, reagent feeding in the flotation section, and operation of the filter plant.



in San Manuel's New 30,000-Ton Plant

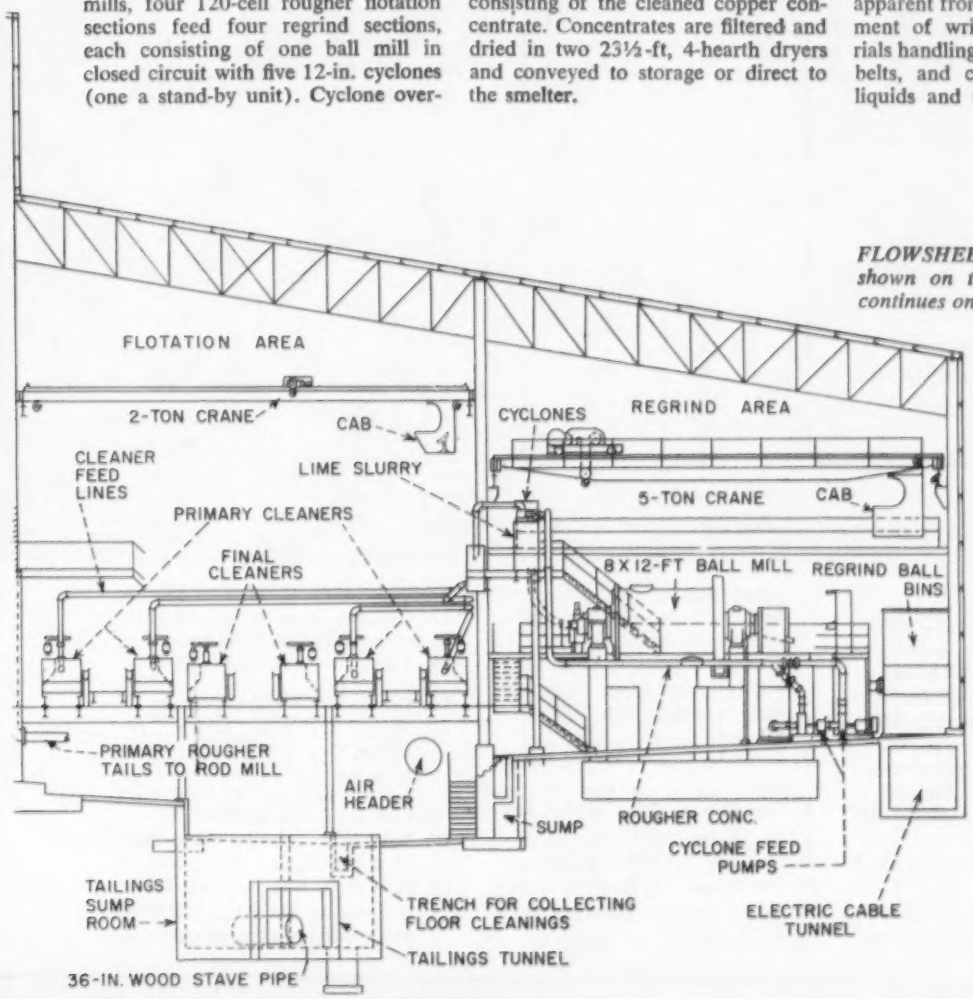
Accompanying flowsheet, plans and general plant sections show equipment and arrangement of units required to run some 30,000 tons of ore through the San Manuel concentrator daily.

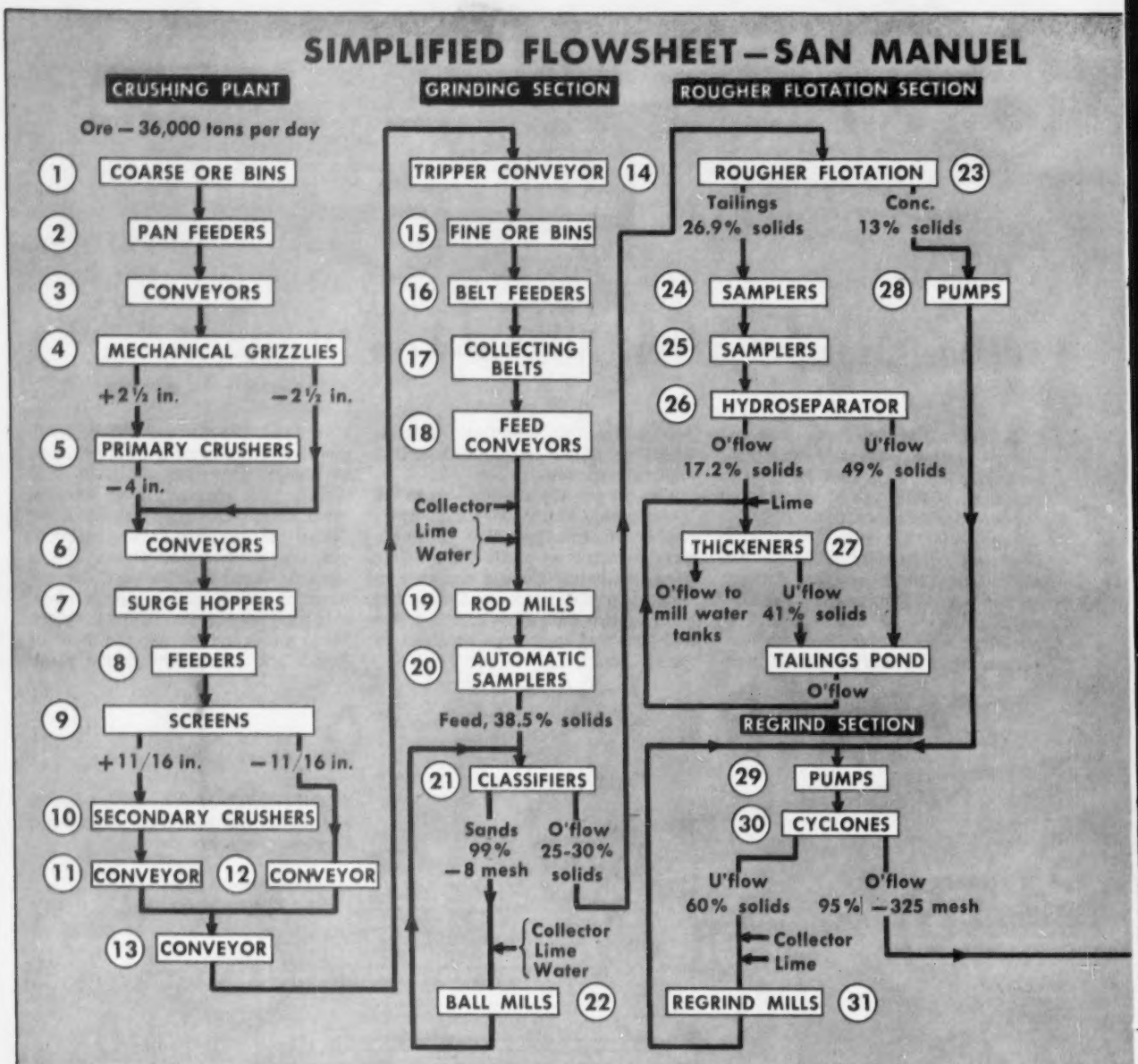
Eight 4,000-ton mill sections each consisting of one rod mill, two ball mills, four 120-cell rougher flotation sections feed four regrind sections, each consisting of one ball mill in closed circuit with five 12-in. cyclones (one a stand-by unit). Cyclone overflow goes to four cleaner sections each consisting of 28 cleaner cells and 8 final cleaner units.

Cleaner concentrates are sent to the moly plant which is essentially a cleaner-recleaner operation yielding a molybdenum concentrate and a tailing consisting of the cleaned copper concentrate. Concentrates are filtered and dried in two 23½-ft, 4-hearth dryers and conveyed to storage or direct to the smelter.

A quick trip through the mill will give you such immediate impressions as these: Structural designers and metallurgical engineers have incorporated much experinced gained in the design and construction of other modern large metallurgical plants. This is apparent from the uncluttered arrangement of wring, piping, ample materials handling equipment, and launders, belts, and conduits for the flow of liquids and solids through the plant.

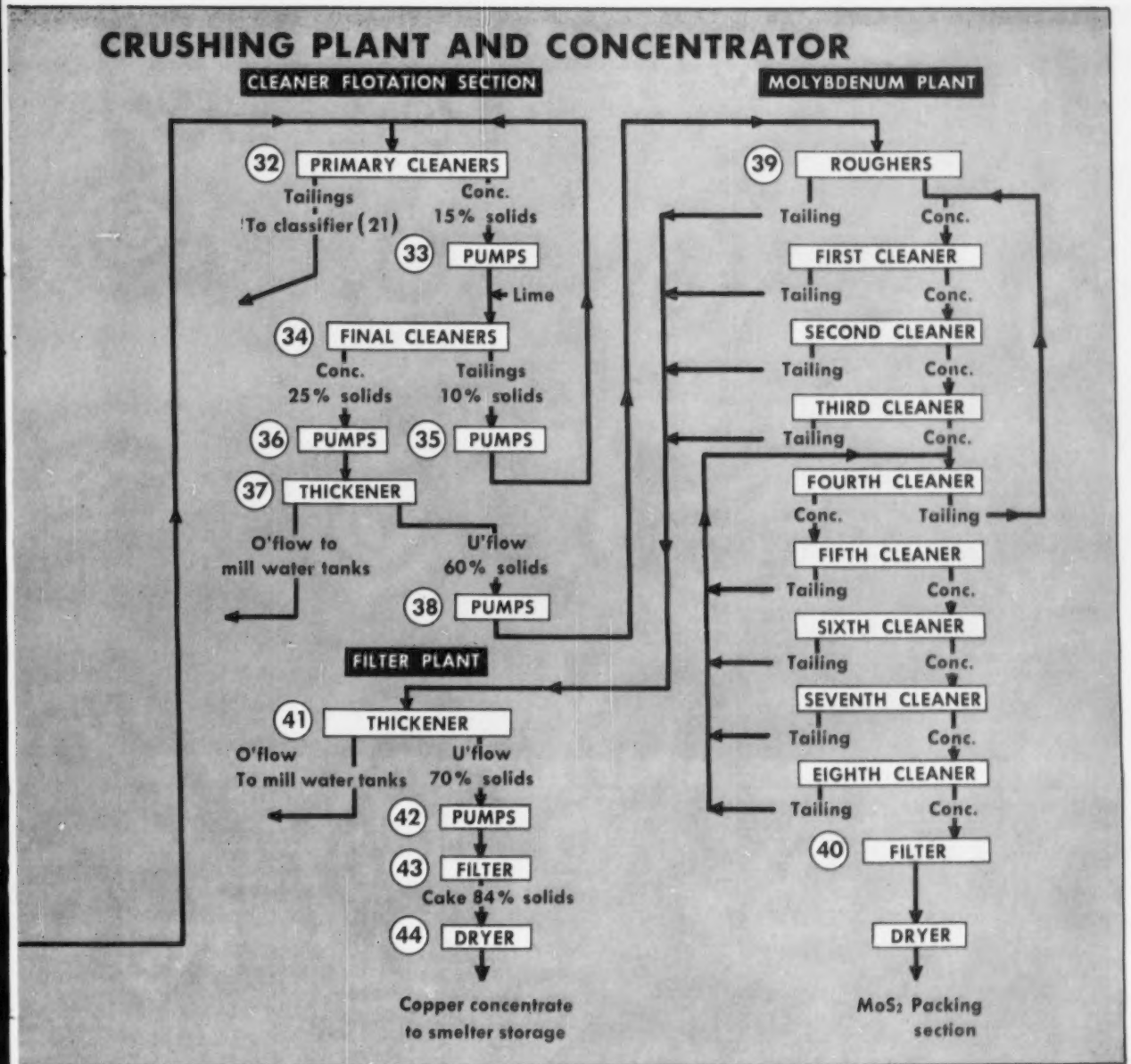
FLOWSHEET of the concentrator is shown on the next two pages; text continues on p 93



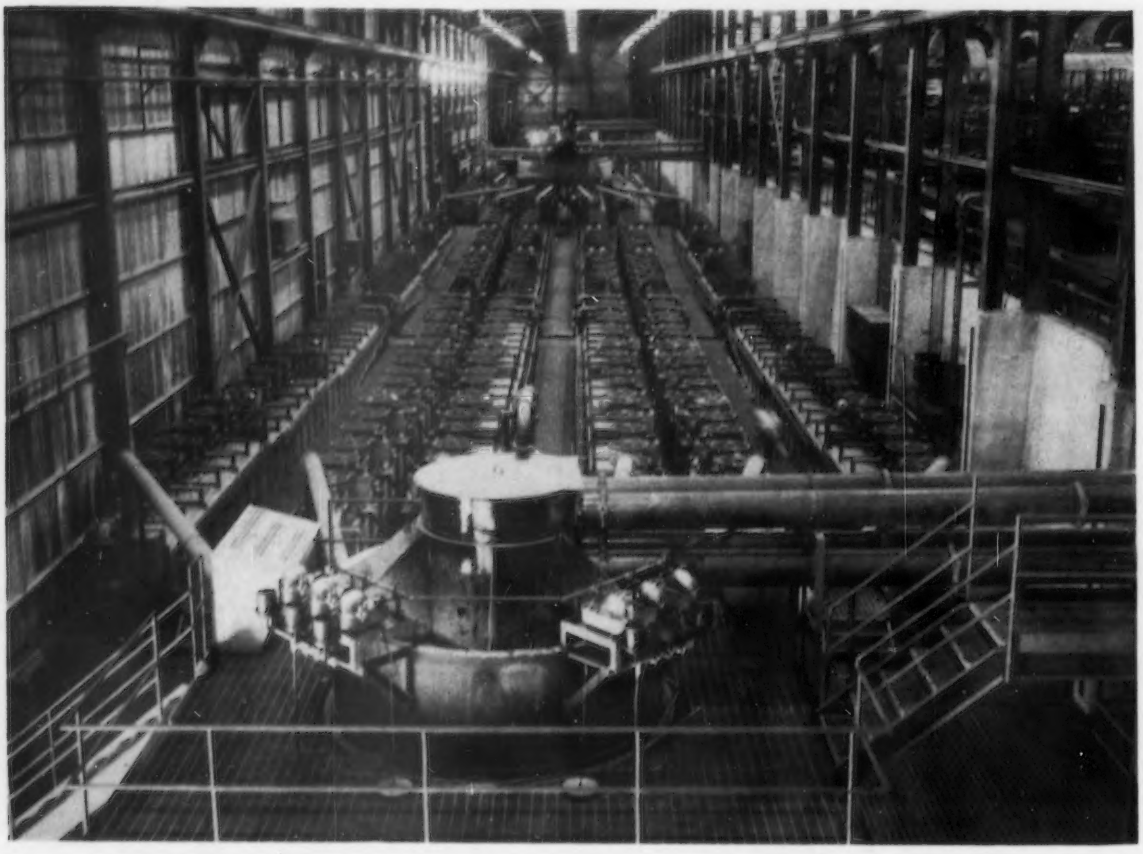


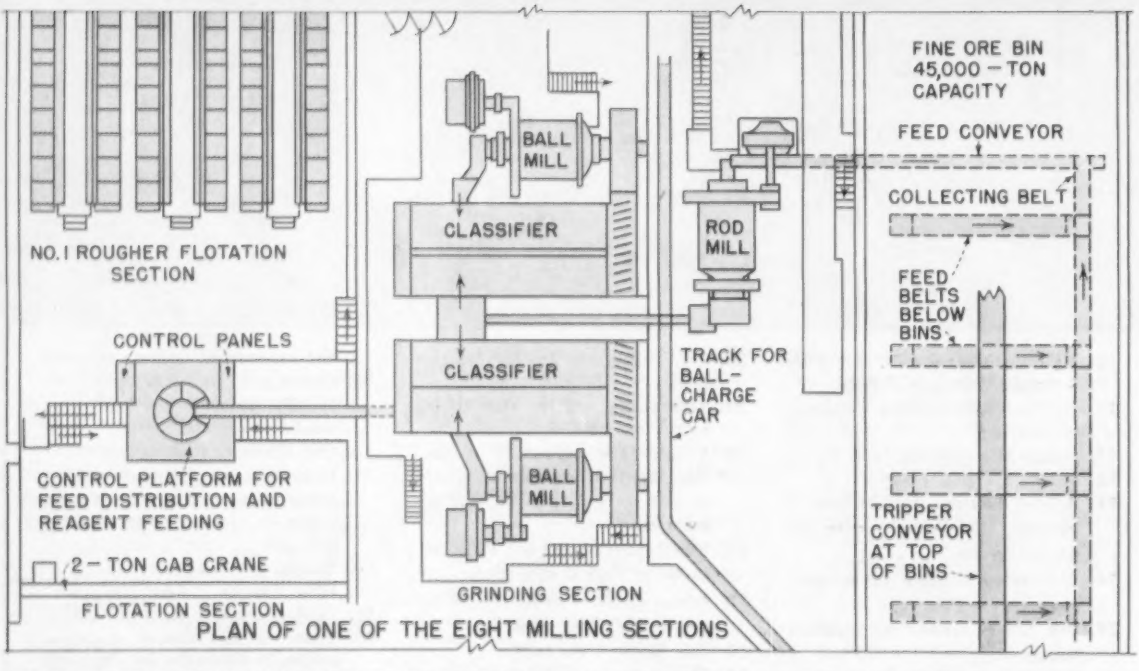
LEGEND

1. Coarse ore bins, 10,000-ton capacity
2. Eight pan feeders, 48 in. x 16 ft
3. Conveyors: Four 48-in. collecting conveyors, 500 tph each at 250 fpm. Two 48-in. impact conveyors, 1,000 tph each at 250 fpm. Two 48-in. conveyors to primary crushers, 1,000 tph each at 250 fpm. Two 72-in. picking conveyors, 1,000 tph at 150 fpm
4. Two mechanical grizzlies, bar spacing 2½ in.
5. Two Symons crushers, 7-ft standard
6. Conveyors in sequence: One 60-in. impact conveyor 2,000 tph at 425 fpm. One 54-in. conveyor to transfer house, 2,000 tph at 425 fpm. One 54-in. cross conveyor, 2,000 tph at 425 fpm. One 54-in. tripper conveyor to surge hoppers, 2,000 tph at 425 fpm
7. Four surge hoppers, 200-ton capacity each
8. Four 48-in. x 15-ft 6-in. belt feeders, 500 tph at 120 fpm
9. Four 6x12-ft vibratory screens
10. Four Symons 7-ft shorthead crushers
11. Impact conveyor, 60-in., 1,272 tph at 250 fpm
12. Conveyor, 48-in., 728 tph at 250 fpm
13. Conveyor, 54-in. to fine ore angle station, 2,000 tph at 450 fpm
14. Tripper conveyor, 54-in., 2,000 tph at 450 fpm
15. Fine ore bins, 45,000-ton capacity
16. Thirty-two 36-in. belt feeders, 4 per section. One feeder in each section to be controlled by weightometer on rod mill. Feed belt 41.67 tph, constant speed belt, 15 fpm
17. Eight 24-in. collecting belts, 166.8 tph at 226 fpm
18. Eight 24-in. feed conveyors, 166.68 tph each at 231 fpm. Regulating weightometer on each conveyor

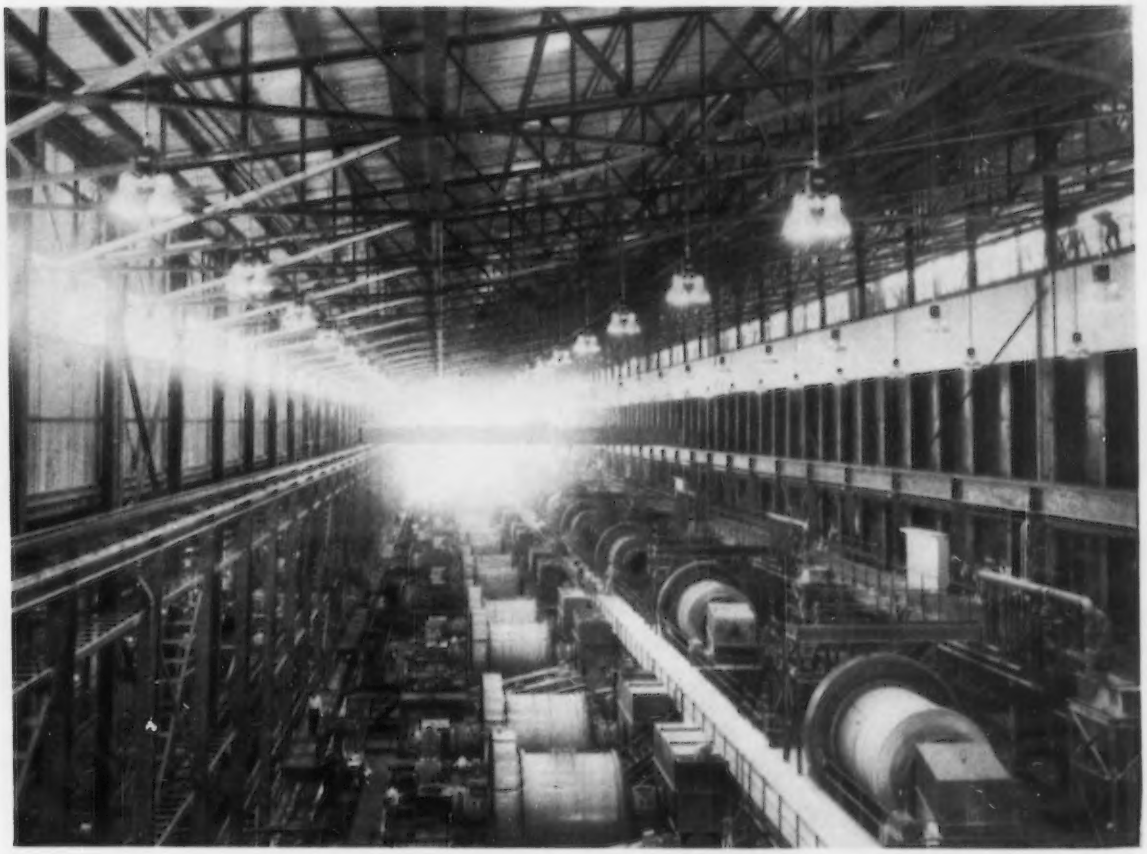


19. Eight 10x13-ft rod mills, 65% solids —8-mesh, 610.4 gpm discharge
20. Eight automatic samplers. Samples go to laboratory
21. Sixteen rake classifiers 16x35-ft
22. Sixteen ball mills 10x10-ft
23. Rougher flotation. Four sections, 6 machines, 120 cells each section, 357 tph per section
24. Four tailings samplers, one for each section
25. One tailings sampler for combined tailings
26. Hydroseparator, 55-ft dia x 12 ft
27. Three 325-ft dia thickeners
28. Four pumps, one for each rougher section
29. Four pumps, one for each regrind section cyclone feed
30. Twenty 12-in. cyclones, 5 per section. One in each section is a standby unit. Feed 17% solids, 62.4 tph per section
31. Four 8x12-ft regrind ball mills. Discharge 31.2 tph at 60% solids
32. Primary cleaner. Four sections, 39 tph per section, 8.2% solids
33. Four pumps, 1 per section
34. Four final cleaner flotation sections
35. Tailings go through sample cutters and pumps to primary cleaners
36. Cleaner concentrates go through automatic samplers and pumps to molybdenum plant
37. One 100-ft dia thickener
38. Underflow goes through diaphragm pumps, to pump box, to centrifugal pumps, to sampler to rougher flotation cells
39. Rougher flotation cells
40. Filter, 4-ft dia, 2 disks
41. Thickener, 100-ft dia
42. Underflow goes through diaphragm pumps, to distributor box, to filters
43. Three 6-ft dia, 8-disk, filters
44. Two multiple hearth furnaces





PHOTOGRAPHS ABOVE AND TOP RIGHT are keyed to this plan of one of the milling sections at San Manuel. Note the control platform in the foreground of the flotation section (above) supporting reagent and feed distribution equipment. Feed to rod mills (top right) is controlled by instrument panels mounted on walkways at far right of the grinding section.



Mill Design Highlights

Generous space and headroom is provided for operators in all parts of the plant. Liberal facilities have been planned to catch and sluice down an occasional spill, and carry off huge tailings volumes. A band of plastic windows below the roof line, admits a soft green light. Two large mill substations are pressurized with four 1,000-cfm 1.5-psi centrifugal blowers to lower operating temperatures of electrical equipment and keep out dust. Adequate seals and dust control units chiefly of the roto-clone type, have been installed close to the sources of dust generation.

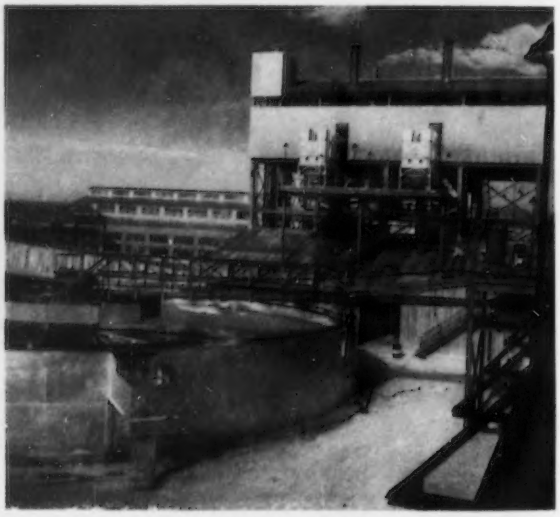
Conveniently spotted push-button control panels at strategic locations in full view of equipment being controlled, show how much emphasis has been placed on sensitive, prompt and accurate regulation of feeding and operating units.

For instance, four control panels, one between each pair of rod mills, regulate operation of the primary and secondary grinding sections. These include the 32 fine-ore feed belts and 8 gathering belts. Precise rate of feed is maintained by regulating 16 of the 32 fine-ore feed belts which may be run at 9.7 to 29.2 fpm. The remaining 16 run at a constant speed of 15 fpm.

Similarly, the mill man has virtually finger-tip control of the flotation sections from four raised circular decks which overlook the rougher and cleaner flotation sections. Pulp feed, reagent feed, flotation machine operation and sampling are all controlled from here.

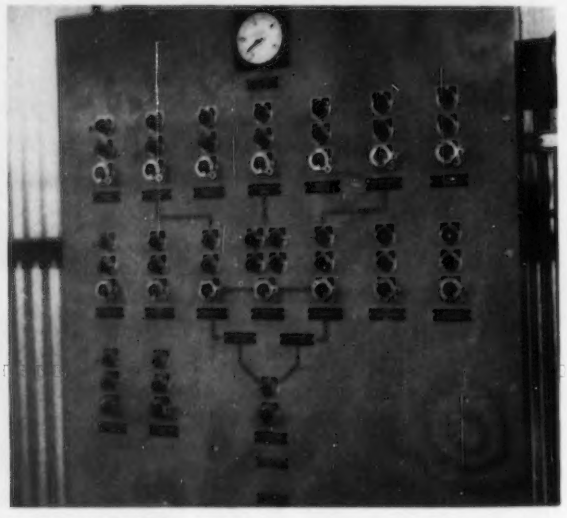
FOUR REGRIND MILLS discharge to pumps (left) feeding cyclones (right).

OVERFLOW FROM CYCLONES is treated in these cleaners.



CONCENTRATE THICKENERS feed modern filter plant.

FILTERED CONCENTRATES drop onto drying hearth below.



INSTRUMENT PANEL controls operation of filters in plant.

Materials handling equipment is installed to eliminate as much manual labor as possible. For example, grinding balls will be transferred from incoming freight cars to four 250-tons ball-storage bins by magnetic crane. They will be transferred as needed by the same crane to two 30-ton storage bins for loading ball cars. Ball cars travelling on a track above ball-mill feed scoops, are hauled by a compressed air locomotive. Down-spouts along this track permit easy transfer of balls from the side gate of the car to the ball mills. A 1,000-lb capacity track scale is installed to keep a record of ball feed to mills. A 175-ton overhead crane enables repair crews to pick up the entire loaded ball mill or rod mill for relining at a repair bay. A similar 2-ton overhead cab crane services the flotation sections. Lime, the principal reagent, is prepared in a lime plant with 7½ x 180-ft rotary kiln and lime slaker and pumped as a slurry to 40,000-gal 35 x 20-ft storage tanks outside the mill for distribution to the reagent control platforms.

Although it is too early to discuss operating details and metallurgical results, it can be said that initial operations of the mill have compared very satisfactorily with the 90 to 92% recovery indicated by test work. This is significant because first ore run through the mill consisted of dump ore produced during mine development.

Here are a few notes covering initial operations of the mill: Reagents used in the flotation section include Minerec, MIBC, Z-11 and lime; in the moly plant flotation circuit, hypochlorite, ferrocyanide and stove oil. The latter three are stored in three 12,000-gal tanks outside the moly plant. Rod mill feed consisted of 78% solids, ball mill, 78-80% solids. Feed to the 12-in. cyclones in closed circuit with the regrind mills runs about 17% solids. Cyclone overflow to the cleaner flotation sections runs 95% minus 300 mesh. Dried concentrates going to the smelter run about 28% Cu and 9% in moisture content.

The Smelter— Unique in Modern Design

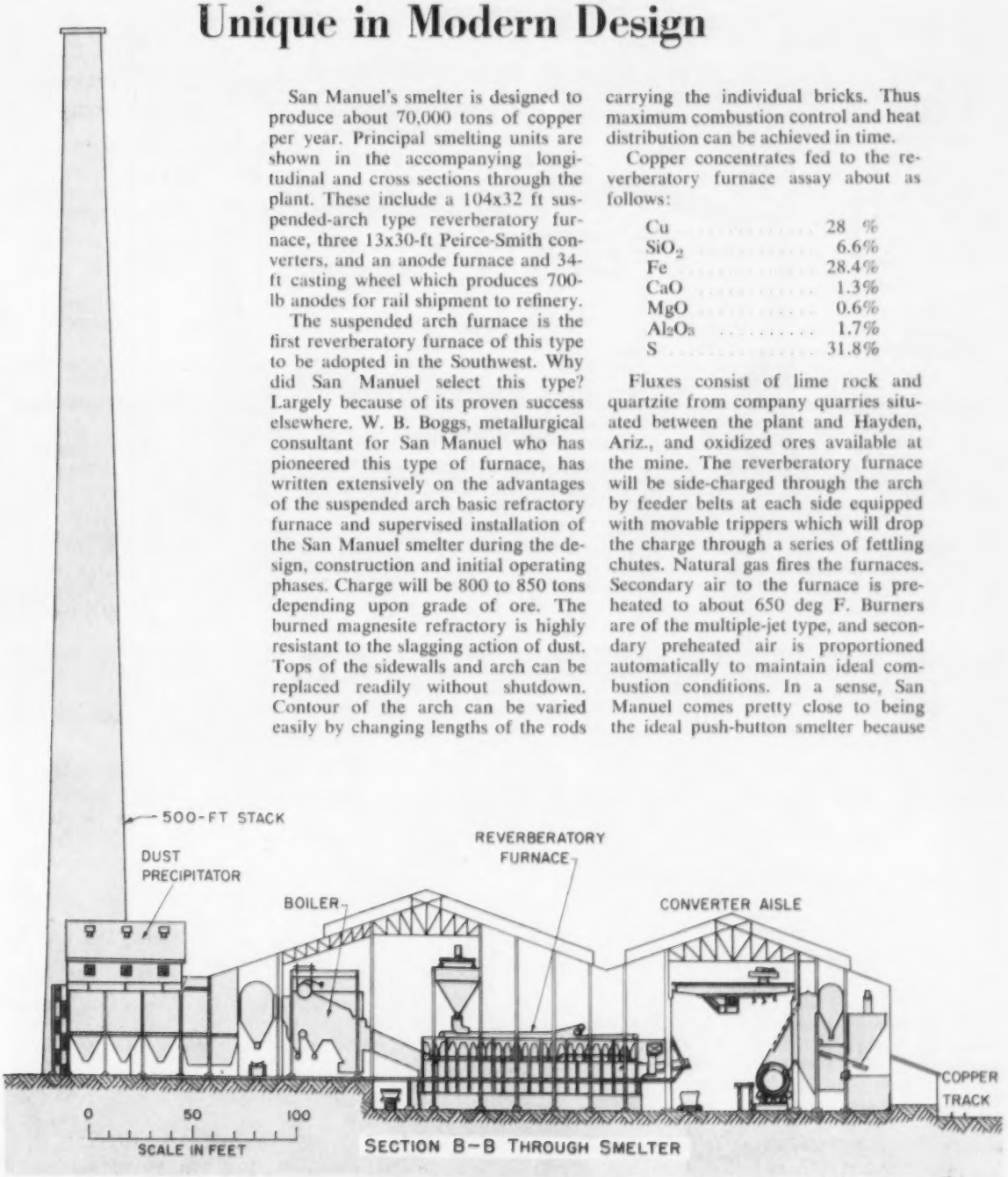
San Manuel's smelter is designed to produce about 70,000 tons of copper per year. Principal smelting units are shown in the accompanying longitudinal and cross sections through the plant. These include a 104x32 ft suspended-arch type reverberatory furnace, three 13x30-ft Peirce-Smith converters, and an anode furnace and 34-ft casting wheel which produces 700-lb anodes for rail shipment to refinery.

The suspended arch furnace is the first reverberatory furnace of this type to be adopted in the Southwest. Why did San Manuel select this type? Largely because of its proven success elsewhere. W. B. Boggs, metallurgical consultant for San Manuel who has pioneered this type of furnace, has written extensively on the advantages of the suspended arch basic refractory furnace and supervised installation of the San Manuel smelter during the design, construction and initial operating phases. Charge will be 800 to 850 tons depending upon grade of ore. The burned magnesite refractory is highly resistant to the slagging action of dust. Tops of the sidewalls and arch can be replaced readily without shutdown. Contour of the arch can be varied easily by changing lengths of the rods carrying the individual bricks. Thus maximum combustion control and heat distribution can be achieved in time.

Copper concentrates fed to the reverberatory furnace assay about as follows:

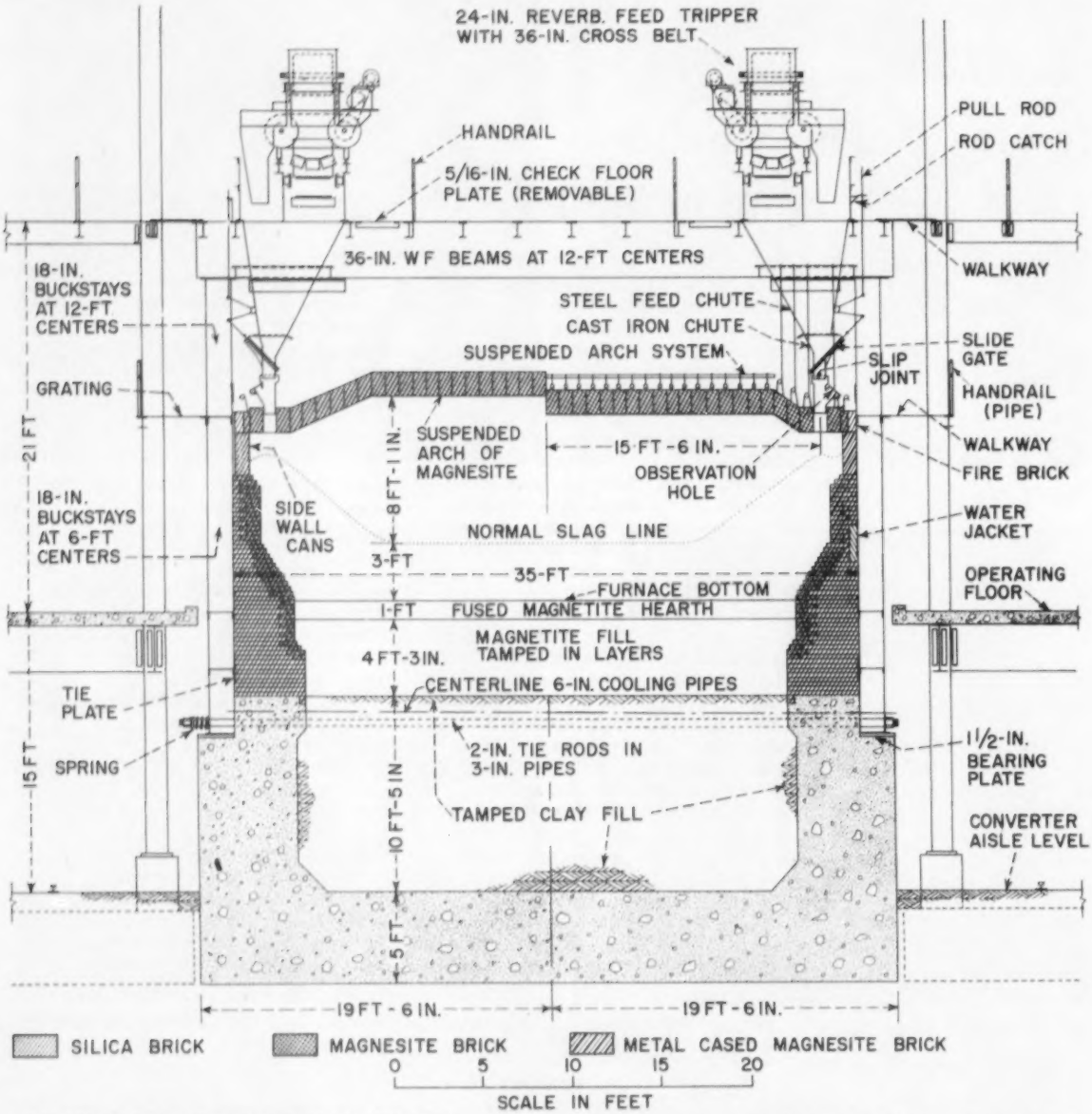
Cu	28 %
SiO_2	6.6%
Fe	28.4%
CaO	1.3%
MgO	0.6%
Al_2O_3	1.7%
S	31.8%

Fluxes consist of lime rock and quartzite from company quarries situated between the plant and Hayden, Ariz., and oxidized ores available at the mine. The reverberatory furnace will be side-charged through the arch by feeder belts at each side equipped with movable trippers which will drop the charge through a series of fettling chutes. Natural gas fires the furnaces. Secondary air to the furnace is preheated to about 650 deg F. Burners are of the multiple-jet type, and secondary preheated air is proportioned automatically to maintain ideal combustion conditions. In a sense, San Manuel comes pretty close to being the ideal push-button smelter because



SECTION B–B THROUGH SMELTER

LOCATION OF THIS SECTION appears on plan view of the San Manuel plant p 87. Oustanding design features include streamlined charge feeding, the suspended-arch reverberatory furnace and strategic push-button control centers.



SAN MANUEL'S SUSPENDED ARCH REVERB is the first to be installed in the Southwest. Other unique features include the flux and concentrate feed system shown on opposite page; also the self-propelled electrically-powered matte-ladle cars.

For Better Smelting—The Suspended Arch and Streamlined Feeding.

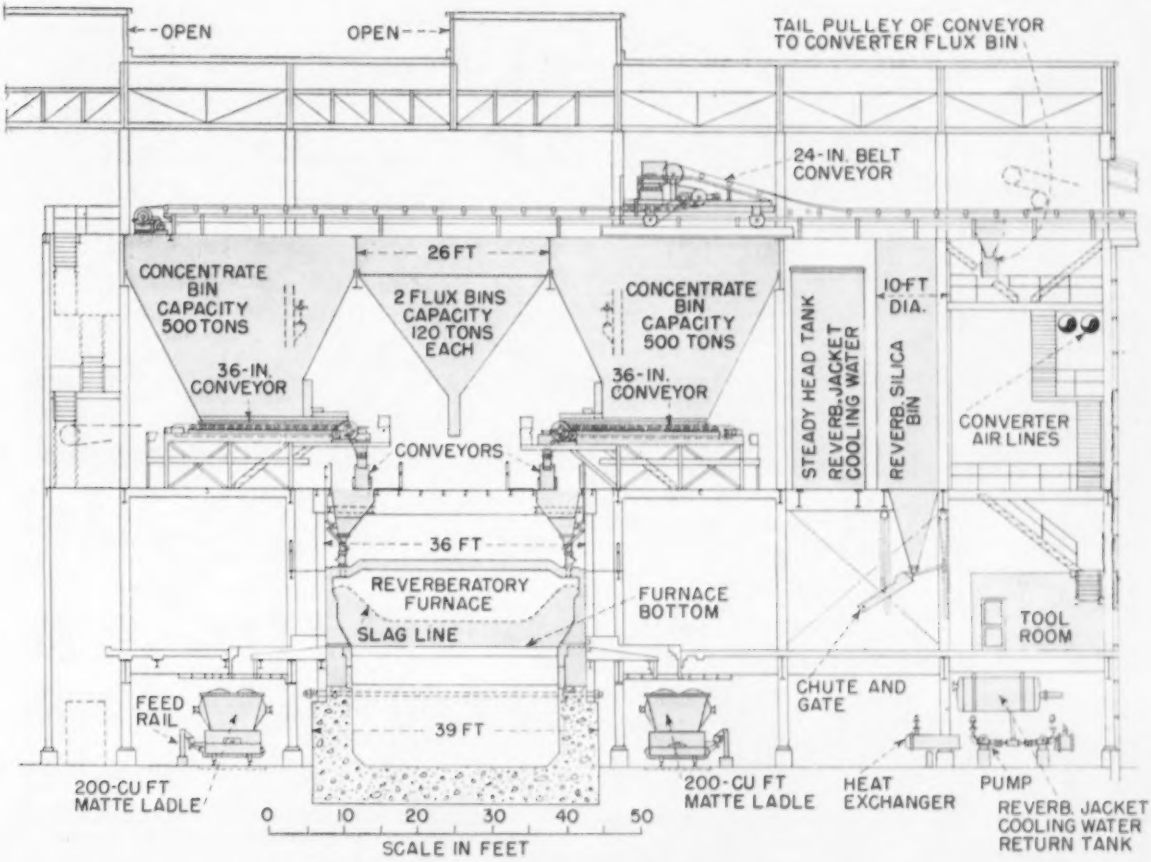
here we see combustion control, furnace draft, furnace temperature, boiler feed-water rate and level, and automatic soot-blowing units operated automatically from one central control panel.

In addition to the protective features of conventional side feeding of furnace charge, refractories are further protected by copper-side-wall water jackets positioned where cooling is most needed. Lest lime be deposited in these cooling circuits, the circulation water is carefully treated, and the furnace operator can readily check flow of water through these critical areas by means of open visual taps revealing the actual flow of cooling water.

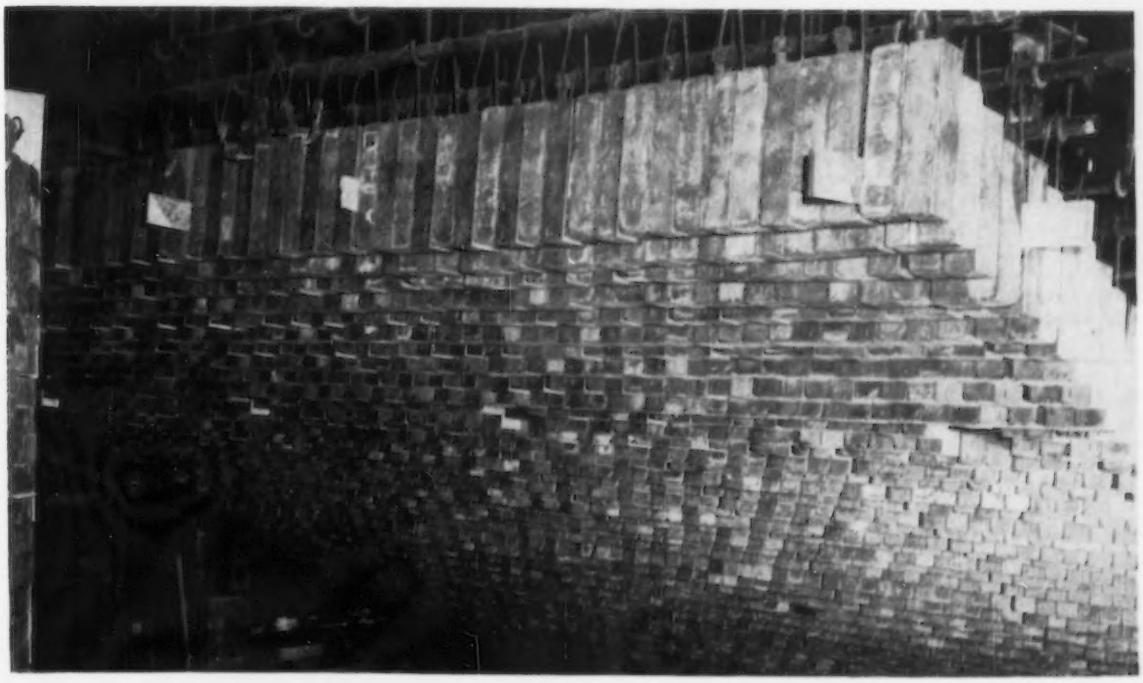
Matte is tapped from the furnace via 2 tap holes on each side of the furnace into a ladle which sets on a self-propelled electrically powered matte car. Matte cars move into the coverter aisle where the ladle can be picked up by crane and poured into the converters.

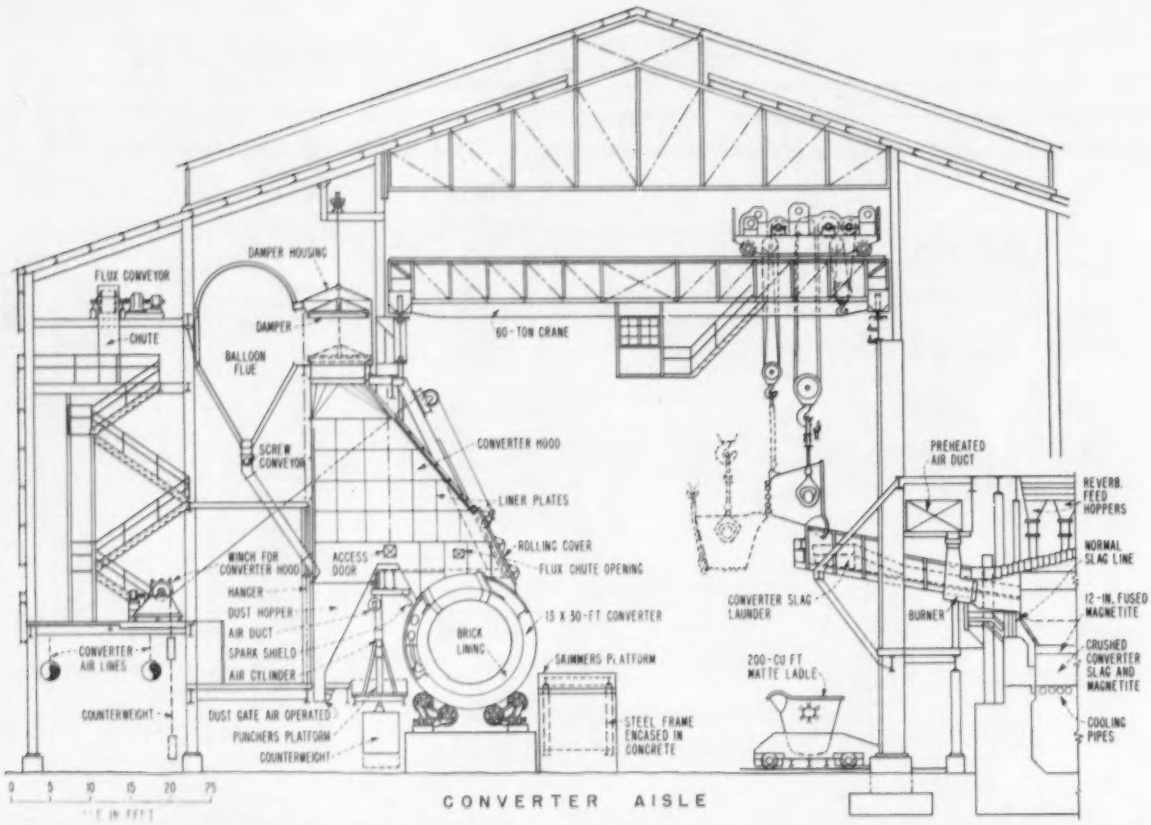
The three converters are lined with hard-burned magnesite brick. Tuyeres are hand-punched. Air is supplied to the converters from 30,000-cfm steam driven turbo-blowers at the power plant at 15 psi. Volume and pressure of air can be controlled by the operator at the skimming platform. Silica flux

Inside the Reverberatory Furnace



SECTION THROUGH REVERBERATORY FURNACE





MATTE IS TREATED in three 13x30-ft Peirce-Smith type converters lined with hard-burned magnesite brick. Materials-handling units, air-conditioned crane cab, and ventilation ducts on punchers' platform have been installed for worker comfort.

is added by a conveyor belt discharging through the side of the uptake hood.

Blister copper then goes to the anode refining and holding furnace where green oak poles are introduced to control oxygen content. Molten copper is then cast into 700-lb anodes on a 22-mold, 34-ft casting wheel. An air-lift hoists transfers the anodes to bosh tanks.

Other outstanding features of smelter design at San Manuel are the following:

Concentrate and flux bins. Two bins holding enough concentrate to operate the reverberatory furnace for 24 hr are installed above either side of the furnace near the uptake end of the furnace. These bins discharge onto the 24-in. tripper conveyors employed for side charging. A flux bin is installed between these two bins for convenient fettling of bridgewalls and uptakes.

Worker comfort. Several features of the smelter show that the designers gave this factor much consideration. All materials handling units are installed for smooth flow of materials with as little manual labor as possible. Two cranes installed over the reverberatory furnace assisted greatly in the installation of the furnace itself, and it is estimated that they more than paid for themselves by the labor they saved and the speed afforded during construction.

Crane cabs in the converter building are air conditioned, and air headers with down jets will provide cool fresh air for the tuyere punchers. Control panels for the reverb, converter and casting wheel operators are conveniently spotted to eliminate motion and effort.

Waste Heat Boilers and the Power Plant

The waste-heat boiler is constructed without baffles from furnace to flue to prevent draft loss and maintain negative pressures which keep gases from leaking out. Experience with a similar design showed that virtually no manpower is required to keep the unit clean, and that the non-baffle design prevents dust from slagging.

Main equipment in the power plant includes a 10,000-kw turbo generator, two 30,000-cfm turbo-blowers, two 300-kw motor-generator sets, and an expansive switchgear and control room connecting with an underground tunnel containing conductors, etc., leading to the concentrator. The power plant is equipped with two condensers, one of which is a stand-by unit capable of condensing steam and returning the water to the waste-heat boiler circuit.

Waste heat gases from the reverberatory furnace and converters are all combined prior to passing through the Cottrell plant. Gases are exhausted through a 500-ft stack constructed of concrete with lining of acid-resisting brick. A 1½-in. glass wool layer insulates the concrete from the brick lining. Flue and Cottrell dusts are collected by screw conveyors and delivered to a pug mill where they are moistened and later delivered to reverb charge.

ALL SET FOR AN EARLY MORNING CONFERENCE are W. P. Goss, president and general manager, Magma Copper Co. and San Manuel Copper Corp., (center); F. H. Buchella, general manager, San Manuel operations, (left); and J. F. Buchanan, assistant general manager operations, Magma Copper Co., and San Manuel Copper Corp., (right).

San Manuel's Operating Staff

E. V. GIVEN, mill superintendent

C. L. PILLAR, mine superintendent

A. A. WALLACH, metallurgist

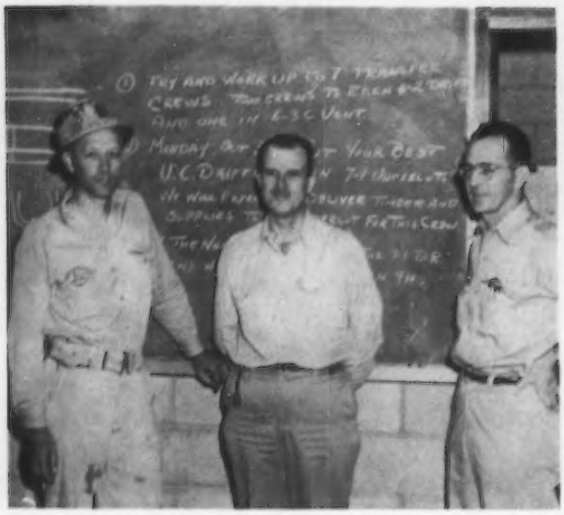
To the Staff

E&MJ's Thanks and Congratulations

Credit for San Manuel's success goes to many people, including those who first recognized the potentialities of the property, officers and directors who arranged early financing of the venture, exploration and development teams, design engineers and contractors, and finally those who are now responsible for operating the project. A list of key members of the present operating staff appears on the next page.

E&MJ would like to thank the officers and staff members who provided the information incorporated in the text and illustrations of this article—particularly because they took time out to extend this courtesy while working under peak pressure to complete the final construction stages of San Manual last fall. A few typical on-the-job photographs are presented here to show San Manuel's team at work.

Our congratulations go to all who participated in the San Manuel project. A special citation is due these men for bringing this huge new copper enterprise into production *six months ahead of schedule!*



BETWEEN SHIFTS, E. K. Staley, assistant mine superintendent, H. I. Ashby, general foreman and J. A. Kline, chief mechanical engineer, discuss operating plans for the day.

THREE DIMENSIONAL MODEL of San Manuel orebody containing more than 100 churn-drill holes is explained by H. J. Steele chief mine engineer and J. D. Pelletier, chief geologist.

R. C. WILSON, smelter superintendent

W. W. SAVAGE, mine safety engineer

V. I. COXON, railroad superintendent

Operating Staff, San Manuel, Arizona

Wesley P. Goss, President and General Manager, Magma Copper Company and San Manuel Copper Corporation
Frank Sarver, Assistant to the President
C. Leo Guynn, President, San Manuel Arizona Railroad Company
John F. Buchanan, Assistant General Manager of Operations, Magma Copper Company and San Manuel Copper Corporation
Frank H. Buchella, General Manager, San Manuel Copper Corporation
Charles L. Pillar, Mine Superintendent
Edmund V. Given, Mill Superintendent
Robert C. Wilson, Smelter Superintendent
Vincent I. Coxon, Superintendent, San Manuel, Arizona Railroad Company
Clyde A. Bilson, Mechanical Superintendent, San Manuel Copper Corporation and San Manuel Arizona Railroad Company
R. P. Diehl, Electrical Superintendent, San Manuel Copper Corporation
E. Keith Staley, Assistant Mine Superintendent
H. I. Ashby, Mine General Foreman
William H. Cann, Mine Electrical Foreman
Allen L. Lester, Plant Electrical Foreman
William W. Savage, Mine Safety and Ventilation Engineer
Dudley M. Berry, Plant Safety Engineer
Hubert J. Steele, Chief Mine Engineer
John D. Pelletier, Chief Geologist
James A. Kline, Chief Mechanical Engineer
Vernon D. Staggs, General Maintenance Foreman—Mine
J. E. Snodgrass, General Maintenance Foreman—Plant
Richard G. Wilbins, Head Transitman
Albert A. Wallach, Metallurgist
Luther Redmond, Smelter General Foreman
Arthur B. Hall, Chief Chemist
Frank G. Rose, Chief Design Engineer
J. C. Sims, Chief Engineer, Power Plant
Leslie C. Acton, Supply Engineer

Watch These Trends

James W. Franklin

CERAMIC OXIDES, NITRIDES, BORIDES AND SILICIDES appear to be the cutting tool material of the future, according to E. J. Tangerman, executive editor, *American Machinist,* in his Special Report No. 417, which appeared in March 12 issue. Report covers the development of ceramics from the early work at Watertown Arsenal to the present time, when six U.S. companies are in the field. Norton Co., Carboloy Dept. of General Electric Co., Stupahoff Div. of Carborundum Co. and Diamonite Div. of U. S. Ceramic Tile Co. now have ceramic bits on the market.

Ceramics differ from cermets in that there is no metal binder, as in cemented carbides or borides. Ceramics are brittle, have no impact resistance and are crystalline in nature. They have very high abrasion and erosion resistance, because of their hardness and high compression strength. Ceramics are non-absorbent, acid resistant, unaffected by corrosion, non-magnetic and non-conductive. Major ingredient in most ceramic oxide tool bits is aluminum oxide (sapphire), running up to 99% of the mix. Rest of the mix may be silica, magnesium oxide or other oxides such as chrome or nickel and a binder material.

Oxide mix is sintered at 3200 deg F or higher, producing a bit with 90 to 95 Rockwell A hardness, compared to 90 to 92 for cemented carbides. Oxide compression strength is 500,000 psi. In general, ceramics are not recommended for machining hard skin off sand castings or for scaling top layer off forged parts. They can be used for this, but manufacturers don't recommend it. Heat conductivity is very low, so unequal heating causes cracking and shattering. Most tests so far have been made without the aid of cutting fluid, since it is needed only to keep the work cool.

Ceramics run better than carbides at high temperatures. They look good for light cuts and fast milling. Many problems remain to be solved before ceramics can compete with carbides. They cut better, but cost slightly more. Bits have to be held with special clamps. Some have been designed, but better ones are needed. Cutting speeds up to 2,000 surface feet per minute are practical. At this high feed rate, steadier machines will have to be designed; ones that can stand the heat and hold still on the floor.

NICKEL PLATING by the old gas-plating process is being revived by Commonwealth Engineering Co., Dayton, Ohio, on a commercial scale. Process hinges on the vaporization of nickel carbonyl, which is picked up by inert gas carrier, jetted into the plating chamber and aimed at the work. Object to be plated is heated above the decomposition point of the carbonyl. Compound breaks down, depositing metal on the work. This process was pilotted by Army Chemical Center, Edgewood, Md., last year, but dropped in favor of a new, now classified method. Commonwealth modification of this old method will handle any shape in tungsten carbide, uranium, stainless steel, other metals and alloys, plastics, fibers and even papers.

POWDERED GLASS LUBRICATING techniques might be applied to production of thin-walled non-ferrous tubing by the non-ferrous industry, according to Comptair Industriel d'Etirage et Profilage de Metaux, Paris. Glass is being used by the ferrous industry as a lubricant in extrusion work, so why can't it be used by non-ferrous? The Institute says that low melting glass powder might make it possible to extrude copper or bronze at temperatures well below 1100 deg F.

ALUMINUM CASTING ALLOY called F 132 has been developed by Aluminum Co. of America as a substitute for Alloy D 132. New alloy has only 0.5% nickel as compared to automotive piston grade D 132, which has nickel content in the 0.5 to 1.5% range. Properties of the two alloys are same.

TITANIUM FROM SCRAP process developed by the Bureau of Mines can produce metal containing less impurities than commercially pure, primary titanium. Method shows promise of cutting the cost of titanium and making more metal available for the metal-hungry market. In the process, scrap titanium is fed into an electrolytic cell and put into solution to be plated out at the cathode, leaving undesirable impurities behind. So far about 70% of the metal produced is premium grade, better metal than pure titanium produced by the iodide process ($100 per pound). Bureau says that process is still experimental, but feel that it is highly practical and will make more metal available on the market.

HIGH-ARC BOILING-REFINING OF METALS, which made news recently is really a further step in the growth and development of a method described in *Engineering & Mining Journal* several years ago. At that time, the process was touted as a new method of refining beryllium. Announcement was premature, as later attempts to pilot the method proved. Dr. Samuel Korman, who made the progress announcement in a chemistry seminar, stated that a well directed research program conducted over the past years (since the premature attempt) has put the method on sound footing.

High-Arc boiling-refining involves mixing highly refractory, siliceous ore with special-grade bituminous coal and forming an electrode by a baking process. Electrode is fed to high current density furnace, which boils off the metals as sub-micron size particles. Elemental metal particles can be separated physically or chemically while still in the vapor state. Process is applicable to highly refractory minerals and several companies have expressed interest in cooperative research programs with Dr. Korman's group.

ZIRCONIUM SAND is a better sand-casting mold material than conventional silica sand or synthetic mixtures, according to National Supply Co., 2 Gateway Center, Pittsburgh 30, Pa. Zircon sand costs five times as much as ordinary mixtures, goes only half as far and cannot be reclaimed for reuse. This in effect makes it 10 times as expensive as silica. Advantage, which makes it attractive regardless of cost is the fact that it makes a smoother casting, particularly in large work. Smoother casting means less cost in refinishing. National uses zircon to mold work up to 30,000 lb in weight.

INDICATION of things to come was the large number of registrants at the Hotel Statler. Operation was smooth-running, despite crowds, and many members had time to renew friendships. Ladies' registration desk was equally busy, enthusiastic.

New York AIME Meeting—

With over 3500 people on hand; with more than 300 papers being read in over 90 different sessions; with breakfast, lunch, dinner and post-dinner activities on tap each of the 4 days, not to mention innumerable informal coffee- and scotch-klatches, any attempt to describe all that took place at the 1956 Annual Meeting of the AIMMPE in New York (Feb. 20 through 23), would be like reporting on the Battle of the Coral Sea from the engine room of a light cruiser. It's difficult at best.

Instead, we present here some of the highlights and side glimpses of the meeting—a polyglot mixture of some of the things that came to light in scheduled papers and unscheduled bull sessions.

More temperance and understanding than usually can be found these days flavored the Canadian view of U.S. mining industry policies. The spokesman was V. C. Wansbrough, vice president and managing director, Canadian Metal Mining Association.

"To our minds it is inconceivable that any serious divergence of purpose should arise between Canada and the U.S. But we can see a danger of policies being adopted which might seriously disturb our normal trade relations. And while we would have no choice but to adapt ourselves to such change as best we might, we should regard it regrettable. We trust that what we regard as the larger and more practical view will prevail and that solutions will be found for domestic problems which will not prove disturbing to your good allies and friends of the country to the North. . . . We would not question the right of the U.S. to take any measures it sees fit to protect a domestic industry which needs more protection for its health or survival. But we who have been supplying your smelters and markets with some 60% of all our lead and zinc exports would ask that consideration be given to the effect of such action on your neighbors and friends."

A prize for plain talk is clearly due Edward B. Douglas, manager Calera Mining Co. The straight-from-the-shoulder title of his paper—"Mining and Milling of Cobalt is No Cinch."

Mining schools got a heavy-caliber boost from John Fayerweather, assistant professor, Harvard Graduate School of Business Administration, who said that mining companies seeking to train young engineers for mine management, and planning classroom instruction as part of the program, will find mining schools better equipped for the job than schools of business or industrial administration.

Major problems of the uranium industry were outlined by Donald T. Delicate, superintendent of mines, Utah uranium division, Homestake Mining Co. as lime penalties and instability of labor, the latter because of limited housing facilities, schools and remoteness of the job.

"Largest tonnage chemical produced in the U.S." is what Robert W. McAllister, chemical and engineering consultant to Arthur D. Little, Inc., told his audience about lime, obviously a bigger business than most suspected.

E. F. Evoy, geologist for Gunnar Mines, Ltd., stated in his paper that, by the fall of 1956, underground development will be advanced to the point where ore can be withdrawn if required. Open pit operations are underway and the uranium mill was completed last fall.

A live, wiggling female discharged onto the grizzly screen by the bucket line is one of the problems encountered in dredging for precious metals in Colombia, S.A. According to Patrick H. O'Neill, vice president of South American Gold and Platinum Co., native divers, many of them women, have taken to diving for nuggets under the dredge itself and, every now and then, a real gem is collected.

Mineral and metal stockpiling has proceeded to a point where domestic mining must prepare to meet

EXCITING SESSIONS were the rule. One of the best attended and most talked about was Calumet & Hecla's presentation on the watering of the Osceola lode. A. S. Kromer, above right, moderated the panel discussion, others gave specific phases.

Highlights and Sidelights

world competition. Of the 55 minerals and metals being piled, 39 are complete, 10 are 75% to 100% full, 6 are over 50% complete and only 10 are less than 50% complete. Within the next few years existing stockpile requirements will be satisfied.

Airborne electromagnetic surveys, improvements in helicopter design and integration of geochemical prospecting were highlights of the H. V. W. Donohoo, Columbia-Geneva Steel Division, U.S. Steel Corp. paper on Mining Exploration.

At the all-Canadian session on Monday afternoon, chairmanned by C. C. Huston, last year's CIM president, there was plenty of evidence that our two countries have many close ties in technology and society. Heading the large group of Canadians was A. L. Penhale, president of the CIM. On the technical side, the difficulties that mining faces in cold climates were particularly interesting, both underground at United Keno Hill Mines and on the surface at Gunnar's open pit. It was apparent that the "more-than-usual" exploratory drilling at Sherritt Gordon's Lynn Lake property led to more efficient mine planning. Leigh Bladon, consultant at Thetford Mines, P.Q., closed the session with several delightful demonstrations of dry British humor in his interesting review of asbestos mining.

Wednesday morning's mining session whipped through a survey of today's hydraulic mining of phosphate con-

WELCOMING SPEAKER Jesse Johnson (right) chats with H. DeWitt Smith.

ONCE MORE into the breach, lads. The hardy and indomitable MBD'ers ate food with their meal at the annual Scotch Breakfast. Once again, all survived.

glomerate in Florida, profitable experiments on drilling and blasting at National Lead's McIntyre pit, cold bent steel arch sets available from Commercial Stamping & Shearing Co. Probably as a result of social contacts having been re-cemented, technical sessions gradually drew larger groups as the meeting progressed. An interesting combination of ore haulage by truck and waste haulage by rail was one facet of Wednesday afternoon's discussion. Cut and fill stoping, circular shaft sinking and igniter cord blasting were also covered. On Thursday it was raising, rock bolting and haulage along with a resumé of DMEA's work in the Pacific Northwest.

Leaching of waste ore at Cananea was presented by R. C. Weed. Process calls for leaching with mine water, which is sprayed onto waste pile spread over the caved, worked out mine. Pregnant solution goes from mine to tin can precipitation tanks. Consumption of tin cans is high, due to iron sulphate content of ore. When leaching zone temporarily quits producing, the work is shifted to a new area until further oxidation takes place in the treated zone. Precipitation of iron salts seals off the tops of leaching areas. This is solved by bringing in a bulldozer and wiping off the sealed layer, then oxidation and leaching can proceed. No acid is needed.

Session on Economic Determination of a Mining and Milling Program, titanium, and Professor Fahrenwald's discussion of his gyrating ball mill were among the best attended sessions in MBD.

At the Mining Branch Dinner, Spencer Shannon, Director of Office of Minerals Mobilization said that he needs several good, experienced men to fill vacant consultant positions at OMM.

Over at the EMD sessions in the New Yorker, the boys took time out from their molecules and ions to listen to what was one of the most interesting speeches of the whole meeting. Dean Curtis L. Wilson, Missouri School of Mines entertained us with a few "rousers" and spoke on engineering advancement of mankind's standard of living. What unions and revolutions couldn't do, engineering did.

A. E. Millar, general manager of Anaconda's Weed Heights copper project, presented colored slides showing complete copper leaching and precipitation procedures. The 8-day cycle of charging, leaching, washing, draining and excavation is carried out in sequence in eight 12,000-ton concrete tanks. Mr. Millar stressed these critical operating details: 1. Agglomeration of ore feed by a six-fold tumbling and spraying process which adds 6% moisture to the dry charge (a critical figure). This eliminates channeling in the tanks and permits maximum downward percolation of the leaching solution. 2. Fast upward percolation in the cementation tanks. This prevents deposition of solids on the scrap iron. Mr. Millar concluded that the speed of upward percolation may be increased still more in the future to improve performance in the precipitation tanks.

That gentleman, complete with beard and standard prospector's attire, seen frequently on Thursday, *was* a prospector, apparently looking for backers on a silver-gold claim. He was carrying samples in that canvas bag.

More than one small group was heard discussing the merits of Carbide & Carbon's continuous radar-controlled miner. It has been used in coal fields since 1950. (See *Coal Age*, December 1952.) Miner is simply pointed at the face, turned loose and operated by radar from a nearby shack. Miner can drag about 1,000 ft of conveyor behind. One operator in shack controls the machine. This miner was the result of work by Carbide & Carbon Co. in late 1940's, went into operation in 1950. Story is that one Western potash producer is testing the idea. On coal, the radar miner will handle about 567 tons in 8 hours.

Calumet & Hecla are to be congratulated for their presentation of Unwatering of the Osceola Lode. Messrs. A. S. Kromer, C. A. Campbell, R. J. Marcotte, P. H. Ostlender and R. R. Spencer worked as a smooth running team in telling the story.

Fluorchemical collectors in flotation. They will float some things, sometimes, and they cost from $5 to $1,000 per lb.

That paper by P. F. Allen of Phelps Dodge Corp. on Tailings Disposal at Morenci Concentrator drew a considerable audience. Morenci replaced trestle system with 3-ft dams and feed pipes built on 3-ft dams and feed pipes.

"Uranium is bound to be the major source of material" for nuclear energy for the next 25 years and more, according to Dr. J. R. Dunning, dean of the College of Engineering, Columbia University. He discounted any hopes for an early taming of the thermonuclear reaction for power, and showed that from an economic standpoint, breeder reactors were less advantageous than those employing highly-enriched uranium.

New atomic defense techniques are developing so rapidly, he said, that even the Defense Department is finding it difficult to forecast its requirements. The whole field of guided missiles is dependent upon atomic and thermonuclear reactions, he observed, and military transport is going over to atomic powered units. "Nobody in his right mind would build anything but an atomic submarine" concluded Dr. Dunning, who foresees an "energy-oriented civilization" which spells an exceedingly strong outlook for uranium requirements.

Robert C. Preuss explained that Continental Uranium Co. decided to use open-pit methods rather than underground mining at its Rattlesnake claims in Utah because experimental test-pit mining in the Salt Wash showed that open-pit methods would yield 300% to 350% greater extraction than underground methods. As of Jan. 1, 1956, 1,529,448 cu yd of overburden had been removed at the company's property.

On project evaluation, James Boyd, vice president, Kennecott Copper Corp., reminded that "mills are built, even today, before deposits have been adequately outlined and there are rusting monuments to such folly in nearly every mining region. . . . No investor . . . should ever undertake to reach conclusions on a new mineral venture without employing those who have experience (consultants) to advise him."

Chairmen of the extra-curricular activities committees —C. DeWitt Smith, Banquet, David Steele, Dinner-Smoker, Pierre Ledoux, Informal Dance—deserve an extra round of applause from all participants.

PERSONALS

Cerro de Pasco Announces Key Personnel Appointments

THREE APPOINTMENTS announced by Cerro de Pasco Corp. recently, include **Harold B. Ewoldt** (left), named assistant to the president for mining matters. Prior to joining Cerro, he served as vice president of Copper Range Co., and as manager of the zinc division of Calumet & Hecla, Inc. **Horace W. Higgs** (center), formerly assistant general superintendent of smelting and refining, has been named assistant manager of operations for Cerro de Pasco. He will continue in residence at the Oroya smelting and refining center in the central Peruvian Andes. **Claude W. Courand,** formerly member of the U. S. foreign service and counselor for economic affairs at the U. S. Embassy, Santiago, has been named general manager of the corporation's Chilean operations, with headquarters in Santiago, Chile.

Herbert M. Weisz, former mine superintendent at Siglo XX and acting general manager since August 1955, has been appointed general manager of the Empresa Minera Catavi of the Bolivian Mining Corp., Catavi, Bolivia.

Arpad Fustos, formerly with Chibougamau Explorers Ltd., has joined Lorado Uranium Mines Ltd., as junior engineer, working on the construction of a custom mill in the Beaverlodge area, Sask., Canada.

John R. Mullen, formerly with American Chrome Co., has joined Beaver Mesa Uranium Company as superintendent of mines, Grand Junction, Colo.

J. E. Berg, former general manager of American Smelting & Refining Co.'s Northwestern Mining Dept., Wallace, Idaho, has retired as consultant to that department.

F. A. McGonigle, vice president and general manager of Manganese, Inc., a subsidiary of Haile Mines, Inc., has been promoted to vice president of the parent company. He is first vice president of the Nevada Mining Association. **Royce Hardy,** former general superintendent of Getchell Mine, Inc., succeeds Mr. McGonigle.

K. A. Young is now associated with Sherritt Gordon Mines, Ltd., as metallurgical engineer at Fort Saskatchewan, Alta., Canada.

James A. Barr, consulting engineer of Mt. Pleasant, Tenn., has sailed on a three month's mineral mission for Europe and Senegal, French West Africa. Mrs. Barr will accompany him.

Robert Mitcham, formerly with Utah Construction Co. in Taegu, Korea, has joined the U. S. Atomic Energy Commission in the mining department of the Grand Junction Operations Office.

Howard A. Mace, formerly with Columbia Iron Mining Co., Cedar City, Utah, has become associated with the Anaconda Company, New Mexico Operations in Grants, N. M.

Gary R. Rice has joined Hecla Mining Co. in Wallace, Idaho, as engineer.

M. F. Hand has taken up the position of assistant geologist with Cape Asbestos S. A. (Pty) Ltd., Union of South Africa, supervising drilling operations at the Pomfret mine of the subsidiary company Cape Blue Mines (Pty) Ltd.

John P. Hamm, former president of the Colorado Mining Association, has been named assistant to the president of Western Machinery Co. Prior to joining the company in 1951, he was engaged in Colorado mining ventures.

Ben F. De Clue Jr., has been transferred from metallurgist at Bonne Terre, Mo., to assistant mill superintendent, Edwards Mill, Edwards, N. Y., for the St. Joseph Lead Co.

Louis Buchman, vice president and general manager, Western Mining Divisions of Kennecott Copper Corp. until his retirement in 1953, has received the William Lawrence Saunders Gold Medal of the AIME for distinguished achievement as a mining engineer.

F. V. C. Hewitt has been elected president and managing director of McIntyre Porcupine Mines, Ltd., Toronto, Canada.

Ray Sullivan, vice president of Continental Uranium, Inc., has announced his resignation to devote his time to other business interests. **Robert Pruess,** general manager of the company, has assumed his responsibilities.

R. J. Cole is now with A. Teichert & Son, Inc., at Stockton, Calif., as a civil engineer.

D. F. Coolbaugh has been appointed consulting mining engineer for United Mining & Leasing Corp. of Central City, Colo.

R. E. Barthelemy, M.E., Paris School of Mines, has joined Carpco Research & Engineering as director of research.

John P. Meador, with the AEC at Grand Junction Operations Office, has recently been made Project Geologist for the Ambrosia Lake Area, Grants, N. M.

Dr. Tell Ertl has resigned as chairman of the mining and petroleum engineering department of Ohio State University, to become a mining engineer and consultant chiefly on oil shale at Grand Valley, Colo.

PERSONALS *(Continued)*

THOMAS K. GRAHAM, superintendent of the Great Falls, Mont., reduction works of Anaconda Co. since 1953, has been named manager of Raritan Copper Works, International Smelting and Refining Co. at Perth Amboy, N. J. International Smelting is a 100% owned subsidiary of the Anaconda Co. Mr. Graham joined Anaconda in 1935.

William A. Vine has been named safety and industrial engineer for Consolidated Coppermines Corp. operations in White Pine County, Michigan.

Floyd W. Erickson, general superintendent at Silver Bay, has been advanced to the position of manager, Babbitt Division, Reserve Mining Co.

Dr. S. C. Ogburn Jr., vice president-research and development of Foote Mineral Co., has retired, but will continue to serve as a management consultant. He joined Foote Mineral in 1948 as manager of research and development, became a board member in 1949, and was named vice president in 1951.

R. T. Whitzel has been named general production manager, and **John D. Harper** has been named general manager of the smelting division of Aluminum Co. of America.

Gaylord D. Simons, formerly with Anaconda Co. as mining engineer at Kelley Mine, Butte, Mont., has been called into the Air Force for pilot training.

Ken H. McMahon has returned to Australia as underground manager of New England Antimony Mines, after 3 years in Canada and the United States.

A. A. Bakewell Jr., formerly at Ruth, Nevada, is general superintendent of Baguio Gold Mining Co., Baguio, Philippines.

Gray S. Willson, project administrator for the Canadian Colombo Plan Survey in Pakistan, has returned to Toronto, Canada as assistant general manager of Aeromagnetic Surveys, Ltd.

Oliver Iron Mining Division has established industrial engineering departments at its district headquarters on the Mesabi range: in Virginia, Hibbing and Coleraine. Men selected for the Hibbing-Chisholm district are **Emmett M. Gilmore,** operating engineer, and **Russell A. Oxendale,** maintenance engineer; at Virginia, **Gordon R. Wynne,** assistant superintendent of Extaca (taconite plant) and **John B. Pardon,** locomotive shop maintenance foreman. At Coleraine the new department will be under **Louis Scipioni,** general pit foreman.

Gene Meyer, formerly with the Colorado School of Mines Research Foundation, has assumed duties as plant superintendent at the Kerr-McGee uranium processing mill at Shiprock, N. M. **Baxter Blitz** was made maintenance superintendent and **Clyde Garman** was named assistant mill superintendent.

Clarence B. Randall has retired as chairman of the board of Inland Steel Co. **Edward L. Ryerson,** former board chairman and now chairman of the executive committee, has retired. Both retirements were effective April 1.

Julius Furman, formerly with U. S. Steel Corp. in Pittsburg, Calif., has joined Convair in Fort Worth, Texas, as metallurgist in the experimental department.

Charles T. Zaoral and **Lee B. Morey** have been elected directors of Vanadium Corporation of America. Mr. Zaoral is president of New York Air Brake Co.

K. D. McBean, M.C.I.M., of the metallurgical staff of Consolidated Mining & Smelting Co. of Canada, Ltd., sailed for Europe March 3, where he will be consultant metallurgist to the Zorka Co. at Sabac, Yugoslavia, in connection with the start-up operations of the new electrolytic zinc plant.

Howard M. Fowler, professional engineer in Alaska and British Columbia, has opened a consulting and exploration office in Vancouver, B. C. The office is aircraft and scintillometer equipped.

D. L. Herrick, vice president of Ace Bushing Div. of Aero Tool Co., has been named manager of mines for Bleak Uranium Co., Salt Lake City.

N. V. Coyle, vice president of Oliver Tyrone Corp. of Pittsburgh, Pa., and a director of the Vitro Corp., has been elected president of Zirconium Corp. of America, Solon, Ohio. **Edward C. Sargent,** former project engineer with Vitro Engineering Division, has been named vice president and general manager of the corporation.

Warren L. Howes has been named manager of Western Knapp Engineering Co. A graduate of the South Dakota School of Mines and Missouri School of Mines, Mr. Howes combines a background of experience in operating and consulting capacities.

W. H. Roxburgh is now superintendent with Canadian Javelin, Ltd., in Montreal, P. Q., Canada.

Blair L. Sackett has retired as metallurgical manager of Tooele, Utah, smelter operations for International Smelting & Refining Co., subsidiary of Anaconda Co., and as a consultant for Anaconda exploration department. He is succeeded by **Carlos Bardwell,** former general superintendent at Tooele. **G. A. Burt,** former ore buyer at Salt Lake City, has been named assistant to Mr. Bardwell, and **W. J. McKenna,** has been named general superintendent. **E. W. Steinbach,** former lead plant superintendent, has been promoted to assistant general superintendent, succeeding Mr. McKenna. **T. W. Saylor** succeeds Mr. Steinbach.

James Allen has been elected vice president of Atlas Corporation. He has been a member of the executive staff of Atlas for the past three years.

T. A. Woods-Smith, mining engineer and geologist, has opened an office in Thessaloniki, Greece.

G. B. Griswold is now employed as a mining engineer with the Wah Chang Mining Corp. at Bishop, California.

A. R. Patterson of Republic, Wash., has been appointed vice president and general manager of Knob Hill Mines, Inc.

Donald L. Everhart, geologic adviser to the AEC, discussed uranium geology before the Rocky Mountain section of the American Association of Petroleum Geologists at Denver, Colo.

Robert Heinrich has joined National Lead Co. as a junior metallurgist.

Dorman S. O'Leary has moved his consulting mining engineering practice from Bakersfield, Calif., to Phoenix, Ariz.

APPRECIATION

Heath McClung Steele died in New York City on February 21st at the age of 71. He had been in poor health for about two years.

Born in Knoxville, Tenn., in 1884, Mr. Steele was educated at the Baker-Himmel School and the University of Tennessee. After practical mining experience in Tennessee, Virginia and Nevada, he became associated with J. R. Finlay in 1911 as consulting engineer, with headquarters in New York In 1917 Mr. Steele joined the American Metal Co., Ltd. and soon afterwards took charge of its Mexican operations. In 1923 he became a director of the American Metal Co., with headquarters in New York, and in 1930 he was elected vice president. He occupied both offices until his retirement at the

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PERSONALS *(Continued)*

end of 1954. Mr. Steele was also president of the Compania Minera de Penoles, S. A., Cia. Metalurgica de Penoles, S. A., Monterrey, Mexico; Southwest Potash Corp., Carlsbad, N. M.; and an officer and director of other subsidiaries of the American Metal Co.; and a director of the Rhodesian enterprises in which the metal company is interested. He was also chairman of the Tsumeb Corp., Ltd., Tsumeb, South West Africa, on its organization in 1947 until his retirement in 1954.

During World War II Mr. Steele served as chief of the Bauxite-Alumina Branch, Aluminum-Magnesium Division, Office of Production Management, in Washington.

By his imaginative leadership Mr. Steele contributed substantially to the growth of the American Metal Co. during the period of his connection with it. He played a large part in the evolution of the company's operations in Mexico and of its copper and by-product refinery at Carteret, N. J. Mainly on his initiative occurred the development of the Pecos Mine, owned jointly by the Metal Co. and David M. Goodrich and associates, which became a large producer of zinc and lead during the 1920's and 1930's. Mr. Steele was primarily responsible for the inception of the Metal Co.'s potash enterprise at Carlsbad, N. M., and the exporation program which led to the Metal Co.'s discovery in 1954 of the lead-zinc-copper-silver orebodies in New Brunswick, Canada, which have since been named in Mr. Steele's honor.

After his retirement Mr. Steele lived at Glen Mary Farms, Great Mills, Md.

Surviving are his wife, Florence Truman Steele, his daughter, Mrs. Sheridan Fahnestock, and two sons, Heath Warren Steele and David Truman Steele, five grandchildren, and his sister, Mrs. Henry Clay Long.

Harold K. Hochschild

OBITUARIES

Corwin L. Cooper, 65, vice president of Knob Hill Mines, Inc., died February 1 in San Francisco, Calif. He had been with the firm since 1936.

Arthur G. McKee, 85, known for his designs of blast furnaces, steel mills and oil refineries, died February 19 at his home in Cleveland, Ohio. He founded his own company in 1915 and was president until 1946 when he became chairman of the advisory board. He was a member of the AIME and ASME.

Francis A. Hancock, 71, mining engineer in Montana and Idaho for the past 25 years, died February 13 in a Missoula, Montana hospital following a long illness. He was a fifth direct generation of Hancock mining engineers.

Thomas Russell Drummond, 82, retired mining engineer, died February 28 at his home in San Juan Capistrano, Calif. Mr. Drummond had extensive experience in mining in the United States, Canada, Philippines and China.

Dr. Walter R. Ingalls, 91, mining engineer, former director of the American Bureau of Metal Statistics and president of the American Institute of Weights and Measures, which he founded in 1920, died February 25 at his home in Bexford, Mass. From 1905 to 1919, Dr. Ingalls was editor of *Engineering & Mining Journal*. He retired in 1947.

Russell B. Paul, 77, authority on zinc ore production, died March 5 at La Jolla, Calif. Before his retirement in 1947, Mr. Paul was resident mining engineer for the New Jersey Zinc Co.

Henning E. Olund, 71, retired industrial analyst, Minerals Division, USBM, died January 22 in Santa Monica, Calif., following a lengthy illness. A mining engineering graduate of the University of Minnesota, he held many responsible positions in the mining industry and was vice president and general manager of Darwin Mines until entering Government service in August 1945.

Charles W. Merrill, 86, authority on gold recovery and board chairman of the Merrill Co., San Francisco, died February 6 in Honolulu, Hawaii. Known for his cyanide process for gold recovery, he directed the recovery operation at Homestake mine, Lead, S. D. for 10 years.

DANIEL C. JACKLING, 86, noted mining engineer, died March 13 at Woodside, Calif. He was credited with the first successful exploitation of low grade copper deposits by open pit mining, a process which permitted swift and spectacular development of the great deposits at Bingham Canyon, Utah.

Mr. Jackling organized the Utah Copper Co., whose properties now are owned largely by Kennecott Copper Co. He was director of Government explosive plants during World War I and was awarded the Distinguished Service Medal.

He retired in 1942 as managing director of Kennecott's western mining properties. At the time of his death he was board chairman of Mesabi Iron Co.

A mining engineering graduate of the Missouri School of Mines in 1892, Mr. Jackling held honorary degrees from the University of California, the University of Southern California and the University of Utah.

He became associated with the late Spencer Penrose, Charles MacNeill and Charles Tutt in the Cripple Creek gold boom in Colorado at the turn of the century. Messrs. Penrose and MacNeall provided $500,000 to help finance Mr. Jackling's development of the mill at Bingham Canyon.

R. KIRBY SHIRLEY, 56, senior vice president and member of the board of directors of Freeport Sulphur Co., died January 24 in a New York hospital. Mr. Shirley, associated with the sulphur industry for 34 years, joined the company in 1922.

Letters

(Continued from page 4)

Co.'s deposit at Boron, California, "is the world's only known sodium borate deposit"?

Tincal, or native borax, $Na_2B_4O_7$-10 H_2O is a rather rare mineral but has been found in numerous places and is a commercial ore of borax.

The deposit at Boron is rasorite, sometimes called kernite, and is the only one of its kind known. This ore has the same formula as tincal or the borax of commerce except that it contains only four molecules of water instead of ten. Theoretically by the simple addition of water, one ton of rasorite should make 1.4 tons of borax. Hence we can say that rasorite is 140% borax!

Leroy A. Palmer
Portland 4, Oregon

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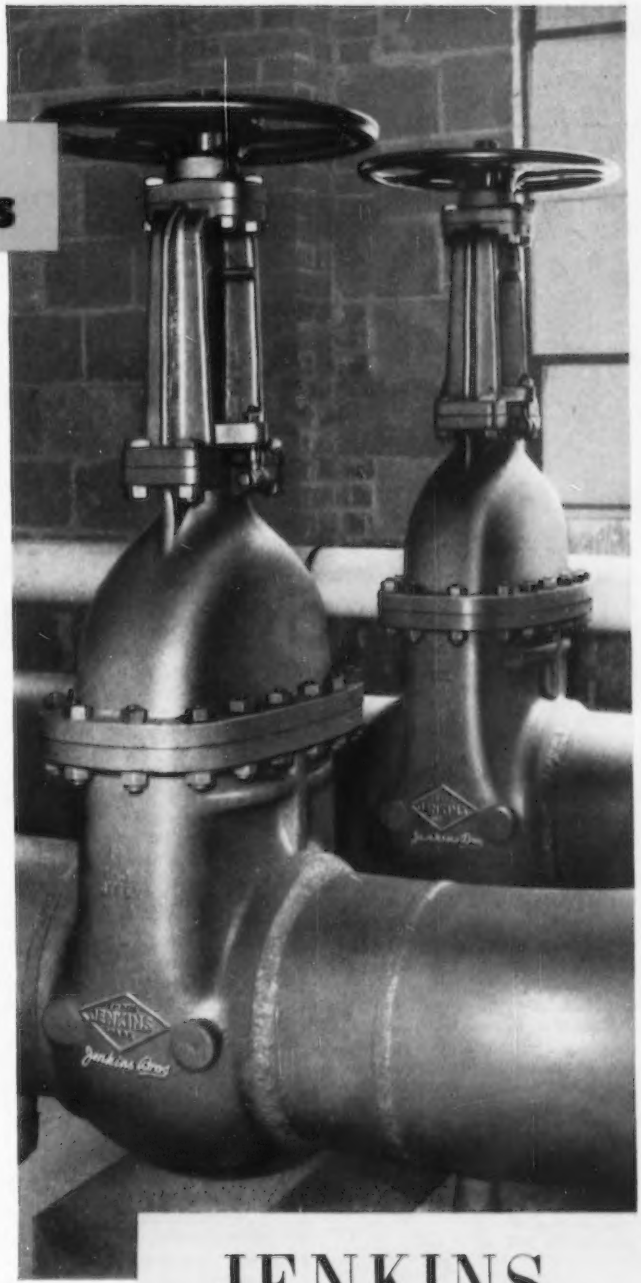

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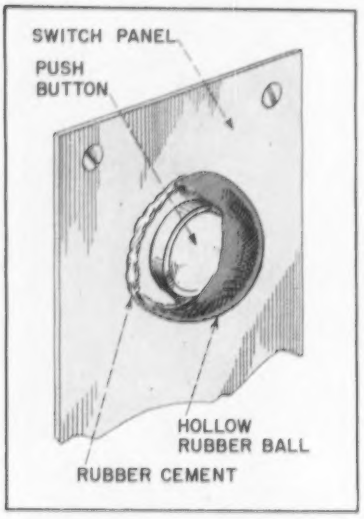
OPERATING IDEAS

LLOYD E. ANTONIDES, Assistant Editor



Pushbutton Is Easily Sealed

A HOLLOW RUBBER BALL effectively sealed pushbutton orifices in switch panel for C. T. Bower, British tool engineer. In his case, the machine could not be taken out of service and the panel had to remain where water and oil would continue to penetrate to switch mechanism. First, a hollow synthetic rubber ball was sliced to give a shallow cup and the cut edge was ground flat using side of coarse grinding wheel. Then rubber adhesive was used to cement flat edge of cup to flat face of panel so that it covered pushbutton. It seals and yet buttons are easily depressed. Colored balls were used for color coding.

Drying Oil Helps Fight Corrosion

TOUGH PROBLEM of corrosion protection for mining machinery is being solved by one manufacturer with iron oxide pigment in a clear drying oil.

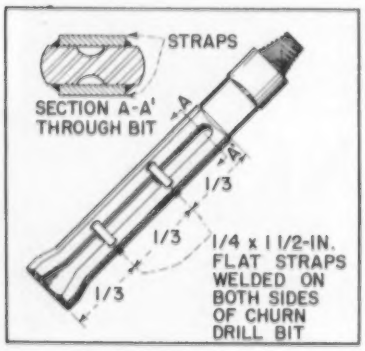
As A. E. Condon, manager of sales, ventilation division, Jeffrey Mfg. Co., says, "Although ours was a problem of manufacture, this easy-to-apply product should provide equally efficient protection to machinery and metal structures, generally, where rust and paint adherence problems have always posed a major maintenance headache to mine operators."

They use Penetrol, made by Flood Co., Hudson, Ohio, as a pigment carrier for iron oxide which is sprayed on fan housing assemblies prior to shipment to customers. This undercoating is only paint applied. Manufacturer's specifications suggest applying Penetrol alone as a base coat prior to an undercoat fortified by the oil. But Jeffrey never found it necessary to use preliminary coat. Its action as a fortifier alone was enough to overcome tendency of paint to blister even after fans are installed.

In fabrication of mine fans, sheet steel oxidizes in storage before being used. And often fans are so huge that they must be built in sections and stored outside until final assembly. All of which promote rusting and blistering of later paint coatings. At mines, if installed outside as is usual, weather raises cain. Underground, dampness and acid fumes continually are at work. But after trying a number of expedients, Jeffrey claims to have hit upon this simple, relatively inexpensive solution which ended all complaints from customers and which promises even wider benefits for general mine use.

Liner Plates Are Used For Bin

CULVERT LINER PLATE was used to build ore bin at American Zinc Co.'s Young Mine at Mascot, Tenn. Cylindrical bin is constructed of Armco liner plates and is 30 ft 8 in. in diameter by 36 ft high. Inside bin is a partition to separate ore and waste, made of steel bridge plank which is trapezoidal-corrugated and normally used to replace worn-out bridge floors. Located adjacent to the headframe and alongside railway, it also has facilities for truck haulage from center opening. Steel bin-type retaining walls which adjoin structure are also made of an Armco product. Heights range from 8 to 14⅔ ft.

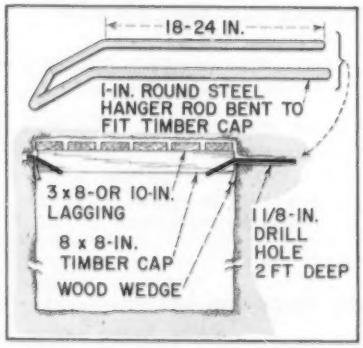


Aids Recovery

TWO FLAT IRON STRAPS welded across the water course on each side of a churn drill bit makes short work of "fishing" for broken bits, says Ernest E. Burgh, mining engineer now at Grand Junction, Colo. They give grapple hooks a ready hold yet in no way did he find that they impeded bit action or water flow.

Mr. Burgh first thought of the scheme while in charge of a contract crew drilling 24-in. diameter ventilation holes for a limestone company. On one of the holes, a 24-in. bit broke off at the collar at about 150-ft depth. After several fruitless hours working with conventional tools, the foreman descended into the hole using a special carriage, and hooked a cable around the broken bit.

Later while sharpening and hardfacing one of the two bits being used, Mr. Burgh instructed the welder to weld four ¼x1½-in. flat bars across the water course—two on each side, about ⅓ and ⅔ up the bit from the face. Next time a bit broke it took less than 30 minutes to recover it using hooks on the sand line. The scheme's success led to welding similar plates or flat sections on smaller bits that were used to pilot the 24-in. bits. The sketch shows bars on a smaller bit.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A BENT STEEL ROD is used as a stirrup for timber caps at San Juan Shaft of Cal Uranium Co., Moab, Utah. Earl Haldeman says silt and mudstone roof makes bolting expensive but this device gives good support without posts or hitches.

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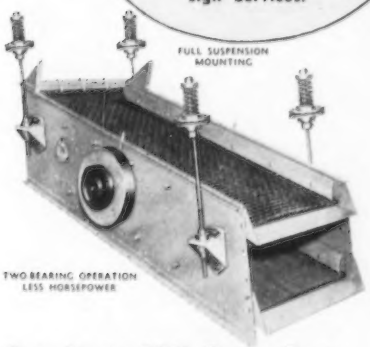

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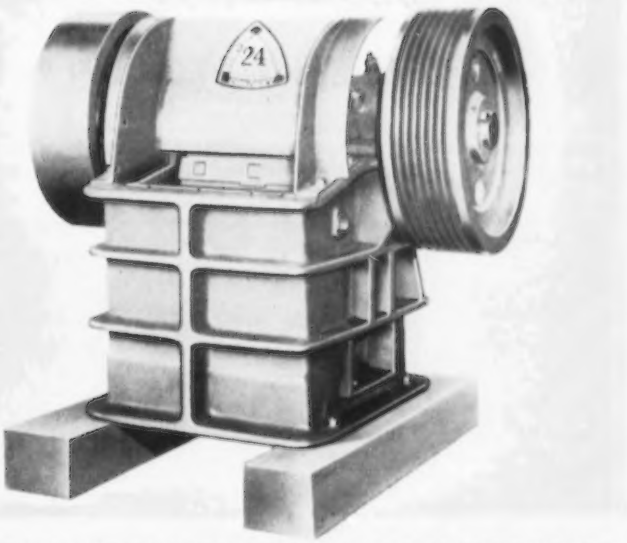

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Pitman bearing troubles—the most serious problem with bronze bearing crushers—have been eliminated by using oversize, heavy-duty roller bearings for the Pitmans on Denver type "H" Jaw Crushers. Prices are comparable to all-bronze-bearing crushers.

Two types of crushers are available—type "H" has anti-friction bumper bearings and bronze side bearings. Type "J" has anti-friction bearings for bumper and side bearings. Available in sizes 5" x 6" to 36" x 48".

2. LONG-LASTING JAW PLATES

Genuine Amsco 13%-14% manganese steel is used for jaw and cheek plates on Denver Jaw Crushers. Jaw plates are reversible so that service life is greatly increased and replacement costs cut.

3. HIGH STRENGTH FRAME

The steel frame of Denver Jaw Crushers is heavily reinforced to withstand more than the most severe service it will meet in its size reduction range.

For complete information about Denver Jaw Crushers, WRITE FOR BULLETIN No. C12-B12.

"The firm that makes its friends happier, healthier and wealthier"

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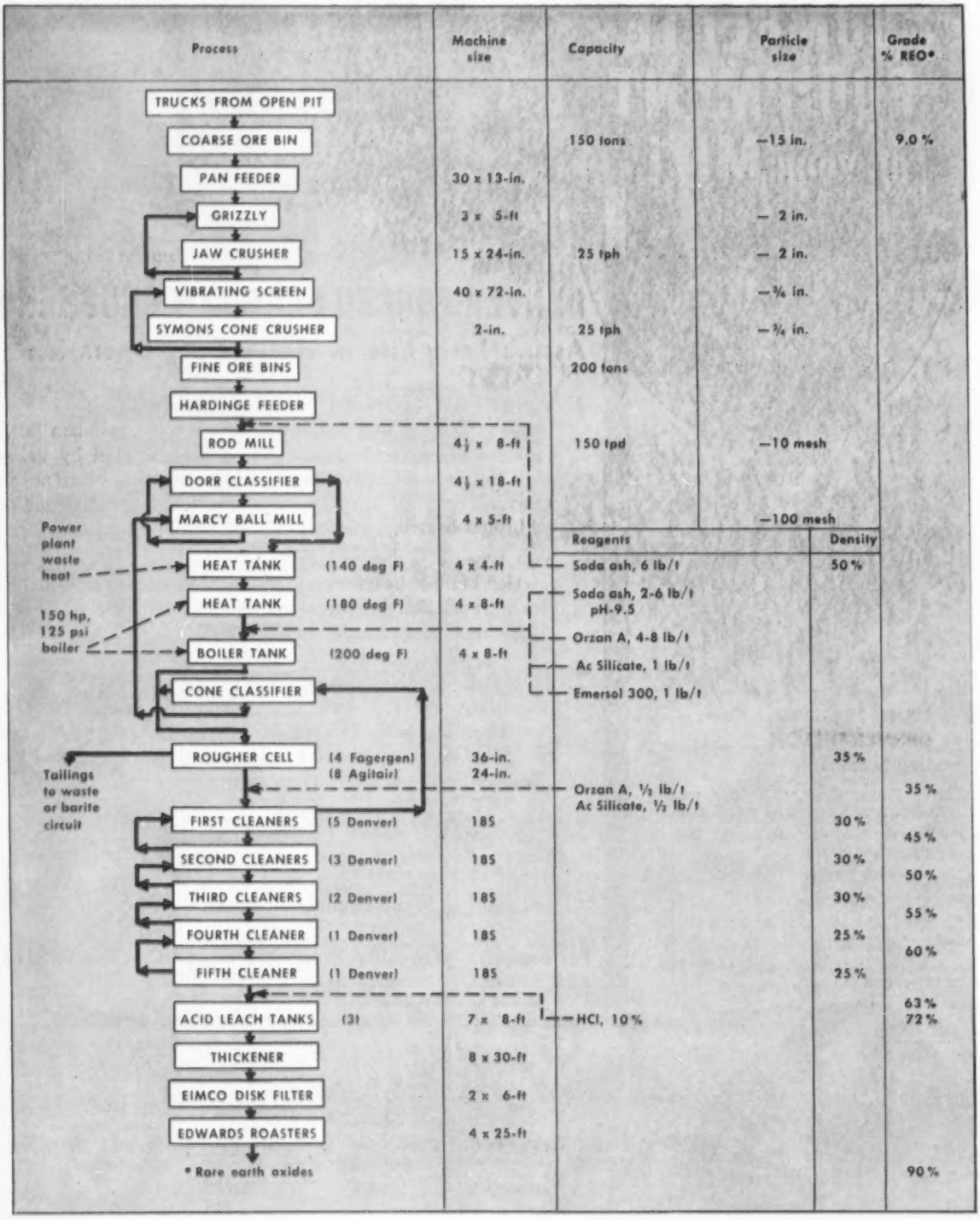
Rare Earths Flowsheet Is Concise and Complete

FLOW AND DATA SHEET presented to visitors at rare earth oxide concentrating mill of Molybdenum Corp. of America, Mountain Pass, Calif., gives whole picture at a glance. Reproduced from typewritten master on letter-size sheets, it is inexpensive and easily carried. Flowsheet below has same form as original passed out at October's AMC tour.

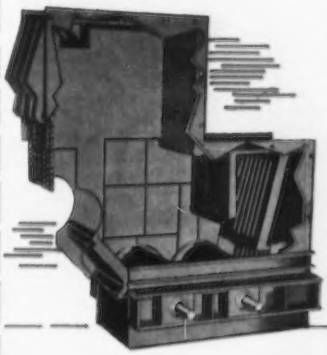


KENNEDY Machinery & Equipment

for the NON-METALLIC MINING INDUSTRY

KVS Machinery and Equipment is in use throughout the world and enjoys an outstanding reputation for dependability, low operating and maintenance cost.

Machinery illustrated covers only a small portion of our line. We manufacture everything from a crusher to a complete mining plant. Consultation with KVS engineers can be arranged anywhere in the world.

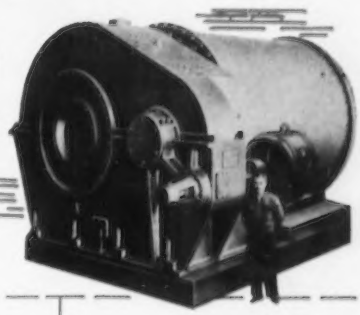


CUBER SENIOR, (Model 3648)

Multi-stage, regulated flow impact breaker for primary and secondary crushing. Dual rotor, triple action. Breaks non-abrasive stone and similar materials. Produces wide range of aggregate sizes with full gradation control. Available in portable or stationary models.

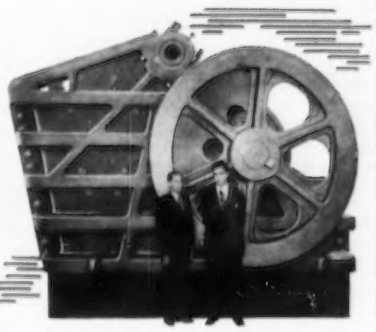
GYRATORY CRUSHERS

Gearless, primary and secondary types in a wide range of capacities. Features include Synchronous Motor, built integral into pulley; power used only for crushing.



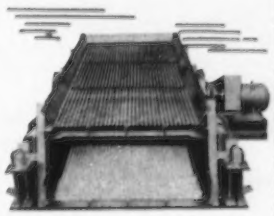
BALL MILLS

Furnished in any length and diameter. Balls may be added while mill is in operation. Available in models for either wet or dry grinding.



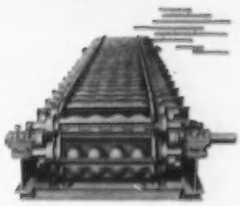
SWING JAW CRUSHERS

Complete range of heavy duty sizes and capacities from 6,000 to 600,000 lbs. Jaw plates reversible, end to end, side to side for long wear. Frames of larger sizes built in four sections for easier installation. Swing Jaw Shaft cast integral with Swing Jaw.



VIBRATING SCREENS

Single, double or triple deck models with interchangeable mesh. Screens have four-way motion; all models available in wide range of sizes.



ROCK FEEDERS

Heavy duty for continuous crusher feeding from steam shovel, truck or railroad cars. Operates at variable speed, equipped with overlapping pans. Widths, from 24 in. to 84 in., in lengths to suit requirements.

Send for bulletin describing KVS Machinery and Equipment

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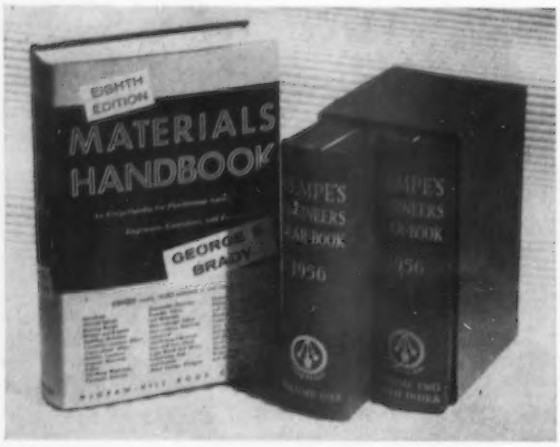
NEW BOOKS



Materials Handbook, by George S. Brady. Eighth edition of this encyclopedia for purchasing agents, engineers, executives and foremen. Handbook gives practical data on approximately 10,000 materials, providing a vast store of constantly useful information on selecting and specifying materials. Metals, alloys, refractories, abrasives, wood and others are all arranged and indexed for quick reference. Published by McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. 966 pp. Price $11.

Kempe's Engineers Year-Book, edited by C. E. Prockter under the direction of B. W. Pendred, editor in chief of *The Engineer*. 61st edition is a complete library and a standard reference for all branches of engineering. In two volumes, it covers modern theory and practice. In addition to revisions of long standard chapters, handbook has added new chapters on electrical engineering, electronics, gas and gas engineering, steam engineering, steam turbines, mining engineering, explosives, industrial safety and protection, concrete, and depreciation. Published by Morgan Brothers, Ltd., 28 Essex St., Strand, England, W. C. 2. Illustrated. 2,637 pp. Price 75/ plus 2/6 postage.

Manual on Rock Blasting, Supplement No. 3. Available in loose leaf form in English, French, Swedish and German. This manual was first published in 1952. Copies of the complete manual may be had for $25.50. Supplement No. 3, $3. Published by Atlas Copco Eastern Inc., Paterson, N. J., and Atlas Copco Pacific Inc., San Carlos, Calif.

Practical Design of Simple Steel Structures, Fourth Edition, by David S. Stewart. In two parts. Published by Essential Books Inc., 16-00 Pollitt Drive, Fair Lawn, N. J. Vol. I, 218 pp. Price 18/. Volume II, 294 pp. Price 25/.

Diesel Operator's Guide, by C. M. Jones. Book is designed to keep equipment on the line and to cut costs. Published by McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. Illustrated. 389 pp. Price $6.50.

World Commerce and Governments, by W. S. Woytinsky and E. S. Woytinsky. Divided in three parts: Part I—Trade; Part II—Transportation; and Part III—Governments. Published by Twentieth Century Fund, 330 W. 42nd St., New York 36, N. Y. 888 pp. Price $10.

Accident Prevention Manual for Industrial Operations. New and expanded edition on safety by the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill. 1,341 pp. Price $13.50.

Principles of Physical Metallurgy, by Morton C. Smith. Starting with the necessary background in chemistry, physics and thermodynamics, this book deals with crystals, and all their manifestations. Separate chapters deal with electrical and magnetic properties and fracture. Published by Harper & Brothers, 49 E. 33rd St., New York 16, N. Y. 406 pp. Price $6.

Alloy Series in Physical Metallurgy, by Morton C. Smith. Takes up where *Principles* leaves off. Composition, heat-treatment, phase rule, solid state reactions, steels, cast irons and alloys. Same address as above. 325 pp. Price $6.

Professional Engineer's Examination Questions and Answers, by William S. La Londe Jr. A guide to preparation for a license exam. Over 500 questions selected from recent exams given in the various states. With the aid of this book and a review course in an Engineering School, one might pass the exam. Published by McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. 462 pp. Price $6.50.

Steels for the User, by R. T. Rolfe. Third edition enlarged and brought up to date. Deals mainly with carbon steels, but alloy steels are discussed in applications where carbons are unsuitable. Published by Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. 392 pp. Price $10.

Writing Useful Reports, by Robert E. Tuttle and C. A. Brown. How to write a report, in all its phases, including a review on grammar. Published by Appleton-Century-Crofts, Inc., 35 W. 32nd St., New York 1, N. Y. 635 pp. Price $4.50.

Design of Piping Systems, by M. W. Kellogg Co. engineering staff. Second edition. Published by John Wiley & Sons, Inc., 440 4th Avenue, New York 16, N. Y. 365 pp. Price $15.

Asbestos, Its Origin, Production and Utilization, by W. E. Sinclair. Published by Mining Publications Ltd., Salisbury House, London E. C. 2. 346 pp. Price $9.

Hydraulic Institute Standards, 1955. Tenth edition. Contains standards for the centrifugal pump, rotary and reciprocating types. Covers specifications, nomenclature, definitions, parts, drawing, materials, application and capacity. Also included is a section on trouble shooting. Published by the Hydraulic Institute, 122 E. 42nd St., New York 17, N. Y. Price U. S. $4.75. Price foreign $5.25.

Keith Arnold in Mining Engineering, by Karl S. Twitchell and Robert Wyndham. Mr. Twitchell started out as an assay-helper and has been a force in mining and petroleum ever since. He helped organize Saudi Arabian Mining Syndicate and Arabian American Oil Co. This "Jack Armstrong"-type novel is a career book for the teenager about adventure in African mining for a young man. Published by Dodd, Mead & Co., 432 4th Ave., New York 16, N. Y. 183 pp. Price $2.75.

Die Bergwirtschaft der Erde (Bodenschätze, Bergbau und Mineralienversorgung der einzelnen Länder), von Ferdinand Friedensburg. Fünfte vollig neu bearbeitete Auflage mit 49 Abbildungen und Zahlreichen Zahlentafelm. Ferdinand Enke Verlag, Stuttgart. 562 Seiten. Geheftet DM 66, Ganzleinen DM 69.

Rocks and Minerals, by Richard M. Pearl. Everyday Handbook Series. Published by Barnes and Noble Inc., 105 5th Ave., New York 3, N. Y. 36 color plates, illustrated and 260 pp. Price $1.95.

• Professional Papers and Bulletins from the Geological Survey may be obtained from Superintendent of Documents, Government Printing Office, Washington 25, D. C. Remittance should be sent by money order. Add one-fourth to cost on foreign orders, except for Western Hemisphere countries.

Bulletin 1027-K, Exploration Drilling for Evidence of Zinc and Lead Ore in Dubuque County, Iowa, by Arthur E. Flint and C. E. Brown. 27 pp. 20c.

Bulletin 1028-B Geology of Great Sitkin Island, Alaska, by Frank S. Simons and Donald E. Mathewson. Map and 21 pp. Price $1.

Bulletin 1031-A, Geologic Investigations of Proposed Power Sites at Cooper, Grant, Ptarmigan and Crescent Lakes, Alaska, by George Plafker. Map and 23 pp. Price $1.

Bulletin 1032-A, Uranium Deposits in the Eureka Gulch Area, Central City District, Gilpin County, Colorado, by P. K. Sims, F. W. Osterwald, and E. W. Tooker. Map and 31 pp. Price 50c.

How the new CAT No. 12 helps smooth your way to*

LOWER-COST PRODUCTION

F & S Contracting Company of Butte, Mont., "sold" themselves this Caterpillar No. 12 Motor Grader because of their previous, extensive experience with Caterpillar equipment. Their new No. 12 racked up more than 550 hours during its first two months on the job. It maintains the haul road for a large Montana mining company.

Like all Caterpillar Motor Graders, the No. 12 is built—not just assembled—by a single manufacturer. This means traditional Caterpillar quality and ruggedness, through and through. It means that engine, blade capacity and working speed are carefully matched for sure-footed traction and high work output. And it means a single source for skilled service and parts you can trust: your dependable Caterpillar Dealer.

And now the Caterpillar No. 12 Motor Grader has important new features for even longer work life at even lower operating cost:

New tubeless tires—available at no extra cost. Tubeless tires eliminate an estimated 80% of down time caused by tire trouble. They run cooler, last longer, give better puncture and blowout protection, and are easier to service than ordinary tires.

Long-lasting oil clutch—can give you 1500 hours without clutch adjustment. Clutch fade is greatly reduced, and facings, which are bathed in oil, wear an average of only 2½ thousandths of an inch per 1000 hours of operation.

Your Caterpillar Dealer will demonstrate the fast-acting, non-creep mechanical controls, unexcelled operator visibility, quick-change blade positioning and other features that make Caterpillar Motor Graders do *more work at less cost than any other graders.* Why not call him today?

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

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99% OF ALL CAT MOTOR GRADERS ARE STILL IN USE

The Year Advertising Helped

IN 1954 we had a business recession in the United States. Sales fell about 4% during the year. If management had followed the historic pattern of business ups and downs, advertising volume would have fallen much further.

But in 1954 the volume of advertising did not fall. It increased over 5%. Every effort was made to stimulate sales when sales were needed to sustain prosperity.

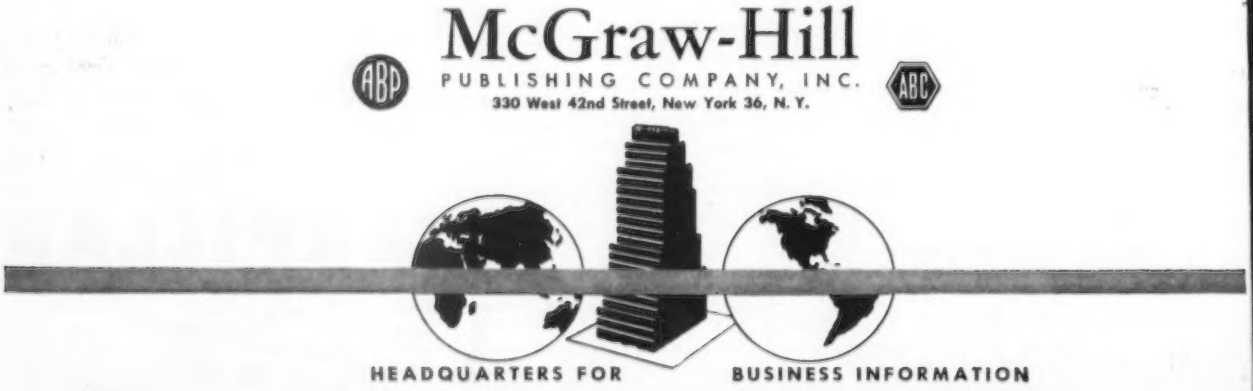
This was something entirely new under the sun. It had a powerful influence in making the recession of 1953-54 one of the mildest on record. It helped greatly to speed business on to the record-breaking levels it has attained today.

There are several reasons why America's business management attacked this decline in sales with more advertising. One of them grew out of the greatly strengthened position of the American consuming market. Consumers' income after taxes has been rising an average of over $10 billion a year since 1946, and this rising income is more widely distributed than ever before. Furthermore, consumers have piled up reserves of about $215 billion in cash or its equivalent. These reserves offer a new and powerful inducement to increased selling and advertising effort even in the face of a possible decline in consumer income.

Taking the Longer View

However, the principal reason why a sales decline was attacked with increased advertising is management's new-found conviction that good advertising is essentially an investment in the development of a market. Successful development requires sustained investment. The inclination of business management to take this longer view, is, of course, motivated by the fact that the American market, with over 3 million consumers being added annually, is growing at a prodigious rate.

Ten years ago only a handful of companies had plans for investment in new producing facilities extending beyond the current year. Today almost all leading companies have investment programs running some years ahead. And keeping pace with these long-range business investment plans has been the development of sales and advertising programs to



Kill a Business Recession

reach tomorrow's greatly expanded markets.

This crucial role of advertising in providing driving power for our economy is gaining greater recognition every day. In his recent book, "People of Plenty," Professor David M. Potter of Yale University remarked: "Advertising is not badly needed in an economy of scarcity, because total demand is usually equal to or in excess of total supply, and every producer can normally sell as much as he produces. It is when potential supply outstrips demand—that is, when abundance prevails—that advertising begins to fulfill a really essential economic function."

Advertising's Key Role

Today abundance so completely prevails in the United States that it has been conservatively estimated that as much as a third of everything offered for sale falls in the realm of "optional consumption." That is, consumers can "take it or leave it" without any immediate personal inconvenience. But if they decide to "leave it," a terrific economic depression will not be far behind. In such circumstances, advertising—in which, in all of its forms, we are now investing about $9.2 billion annually—clearly is of crucial importance to our continued prosperity.

In performing its key role in past years, American advertising never realized its full potential. It successfully promoted sales. But it never was called upon to promote an overall economic stability as a direct outgrowth of increased sales.

By successfully promoting both sales and economic stability, as it did in 1954, advertising surely has added new strength to the American economy. It has also added a great new and constructive dimension to advertising itself. This accomplishment gave great significance to the celebration of the first National Advertising Week in February, 1956.

One of the surest means of expanding your sales volume in today's $150 billion *industrial* market is through dominant advertising in the publications directly serving your major customers and prospects.

McGraw-Hill's business and technical publications can give you quick access to the men who initiate, specify and approve the purchases of industrial products and services. Because all are leaders in their respective fields, you are assured a maximum return on your investment when you specify a McGraw-Hill publication to carry your advertising to your most important markets.

Stockpile Study by Congress Is Due

GOVERNMENT PURCHASE PROGRAMS for domestic minerals are the hot topic of debate in Washington this month. Both Senate and House Interior Mining Subcommittees will hold hearings to consider seriously revamping both the philosophy and the mechanics of current programs about to expire.

Senator James Murray (D-Mont.) and 22 Democrat and Republican colleagues have introduced legislation to take the present purchase program for seven basic strategic minerals out from under Office of Defense Mobilization and General Services Administration, put it under Interior Department in the hands of a newly created Strategic and Critical Minerals Production Administration. A companion bill has been dropped in the House hopper by Rep. Grace Pfost (D-Idaho) and several bipartisan cosponsors.

Here's what S.3454 and HR.9999 would do:

(1) Supplant ODM-GSA buys of asbestos, beryl, chromite, columbium-tantalum, manganese, mica and tungsten with direct price supports to the producers of these materials.

(2) Shift the aim of the program from assuring the Government of adequate emergency supplies of these materials to building up a long-range production incentive for the producers.

Present ODM-GSA programs for the seven minerals will run out between this summer and next, depending on whether stockpile goals or dollar limits for the various items are met first. ODM Director Arthur Flemming has authority to continue them, but he has repeatedly told Congressional inquiries that he views the program as solely a charter to build up adequate emergency defense supplies—a goal which has been virtually reached in each of the seven materials.

The price GSA has been paying for its purchases is set by ODM formula at a rate above current prices on the open market, as an incentive to assure continued production.

This is the basis for much of the recent Congressional thinking that the emphasis should be switched to a partially planned economy for domestic mineral producers, on the grounds that a healthy industry is almost as important, if not as important, as meeting emergency stockpile needs.

Under the Murray Bill, Interior would directly pay producers the difference between what price they got for their product on the open market and the current ODM above-market price floor. Supporters of the measure liken it to the straight price support plan in the Wool Purchase Act, will argue during committee debate this month that it will cost the Government less than the present program.

Debate on the Murray Bill will bring to a head the battle between the two schools of thought on Government minerals policy that's been waging in Washington for some time. The one view—as expressed by Interior Secretary Douglas McKay, Flemming, and their top Administration aides—holds that while a healthy industry is a desirable and important goal the Government has no legal authority to do more than assure an adequate emergency stockpile. This view also reflects traditional Republican philosophy that Government should stay away from subsidies and other artificial supports, let industry work out its own problems freely and without "interference."

The opposing view holds that the domestic minerals industry has been maintained and expanded on necessary support programs since World War II, and that these supports cannot now be withdrawn, even if current emergency stockpile goals have been met, without damaging effects. This school has criticized the Administration for lacking an over-all minerals policy.

There are strong indications in Washington this month that the two opposing views may be compromised. There is a feeling among several top Government mineral policy makers that a middle ground must be found. And on Capitol Hill, supporters of mining interests are showing a willingness to explore a number of possible solutions.

For example, Interior and ODM, while not expected to back the Murray Bill, may propose alternative suggestions to the committees. And in addition to the Murray Bill, legislation is being dropped in the hopper on both sides of Congress in the form of separate bills to continue each of the seven domestic mineral purchase programs under their present setup. In the Murray Bill itself, the perennial proposal to base price supports on production costs—the so-called premium pricing plan which has been firmly opposed by the Administration—has been dropped. At the same time, Administration officials may be willing to take another look at Murray's bill to set up a Cabinet-level department for materials policy—heretofore not conceded much chance. This measure has been reintroduced this session by Murray and Pfost.

AEC Zirconium Needs Increase

REOPENING OF USBM'S zirconium plant in Albany, Ore., is a key to the atomic metal's future.

Atomic Energy Commission requirements can't be met fast enough, say Government experts in Washington. AEC asked Interior to reopen its Albany plant to boost strategic supplies, but sees private industry as the best eventual source. Market analysts predict a bright future for the material, despite costs of gearing up to highly technical production of pure reactor-grade metal.

Right now, AEC needs over 500,000 lb of zirconium a year, figures it will need at least that much each year for the next five. It has invited bids from private industry for 2-million lb over a five-year term, or 1.2-million over a three-year stretch. Ten prospective producers have submitted plans, which AEC is going over now. Sources in Oregon reported earlier that 56 bids were submitted after the original announcement.

This represents a significant boost in AEC goals. Back in 1948, AEC first got interested in the metal as a construction material because it does not absorb neutrons. It asked USBM to expand its small pilot plant at Albany—which was turning out only a few pounds per year—to a 280,000-lb capacity. AEC and the Navy's BuShips, which used zirconium in the atomic submarine Nautilus, financed the operation.

Several private producers have made a start toward full-scale production since then, but only one—Carborundum Metals, Inc., of Akron, N. Y.—has been producing the pure reactor-grade metal since 1953. Carborundum supplies AEC 200,000 lb or $16-18-million worth a year. Other producers have turned out lower grades for non-military uses.

In January 1955 AEC asked Bureau of Mines to shut down the Albany operation, though asking that it be kept on standby, ready to open up again on 90-day notice. At that time, AEC thought it could meet its needs with Carborundum's output until other producers got on the market.

Then came the Geneva meeting on Peaceful Uses of Atomic Energy last summer. Technical reports at this meeting reawakened interest in both defense and civilian uses for zirconium and its by-product hafnium.

Hence AEC's request to USBM to reopen Albany, with an estimated 300,000-lb annual capacity.

Meanwhile, AEC still has its hopes on private industry. It is showing the Albany operation to the ten contract bidders, may subcontract it to one of them. The subcontract would run for only 18 months, by which time AEC again thinks industry may be jumping on the bandwagon with private plants.

(*Continued on p 120*)

For long, trouble-free service . . . use Quaker hose

AIR Extra lightweight, highly flexible hose for heavy duty work. Resists weather damage and abrasion. Non-porous tube of oil resistant rubber compound. Rugged Neoprene cover. Ideal for almost any hose installation.

FIRE Resilient, flat-folding hose saves space and gives long service in interior fire protection. Highly flexible and resistant to cracking. Leak-proof tube bonded to strong single jacket cover. Recommended for institutions, offices, ships, etc.

STEAM Many times stronger than wrapped fabric hose for general steam-handling jobs. Also lighter, more flexible and kinkproof for easier handling. Steel wire and glass reinforcing insures extra safety. Resists high pressures up to 388° F.

WELDING No twisted, tangled lines. Two lines are securely bonded together to form a single, safe hose unit. Kink-free and resistant to welding gases. Stands up to lots of dragging across rough surfaces. Especially effective on portable welding dollies.

WATER For long wear and outstanding value, this easy-to-handle hose has what you need. Reinforced with multiple plies of high tensile yarn, it takes higher than usual working pressures. Cover stands up to weather extremes without cracking or peeling.

Save time and money. Call your Quaker-Quaker Pioneer distributor first, *when you need hose or other industrial rubber products. You'll find him prompt, dependable.*

DIVISIONS OF HKP H.K. PORTER COMPANY, INC.

H. K. PORTER COMPANY, INC.
QUAKER RUBBER DIVISION
Philadelphia 24, Pa.
QUAKER PIONEER RUBBER DIVISION
San Francisco 7, California

Pilot Plant Will Begin Uranium-Lignite Research

LIGNITE BEDS may provide an important new source of uranium. At least AEC is interested to the extent of contracting with a private operation—Ohio Oil Co. and Arthur E. Pew Jr., of Philadelphia—to build a pilot plant at the Colorado School of Mines.

The pilot plant will explore new ways of extracting uranium from the vast lignite beds in western North and South Dakota. If successful, a full scale extraction mill will be put up next year.

AEC's interest stems from the fact that the U. S. has no permanent domestic source to make it independent of foreign uranium imports. The lignite beds may, some experts think, provide this source.

But, there are drawbacks. For one thing, yield is estimated at 0.2-0.4%. It could be much higher if carbonaceous material could be burned off, but most lignite won't sustain combustion. Also, present ore refining techniques can't be applied. Another hitch is high operating costs.

But even if the lignite beds run only 12-18 inches deep—another fact the experimenters will have to determine—the vast fields may lend themselves to open pit mining which would make up in quantity what it lacked in yield.

ODM Will Free Nickel

ODM HAS AUTHORIZED diversion of 18-million lb nickel to civilian industrial uses through the second quarter, with the major portion diverted to premium price ferronickel and nickel ingot. An additional 1.5-million will be available from the GSA plant at Nicaro, Cuba. In December, ODM announced diversion of 4.1-million lb nickel from stockpile and defense needs to civilian use in the first quarter. Diversions are made to relieve continuing shortage of the metal.

Late Developments

COLUMBIUM AND TANTALUM, scarce in the U. S. since before Korean War, are now in plentiful enough supply to meet all known civilian uses, Bureau of Mines reports. Last year domestic consumers used less than half the 5,000 tons available, 99% of which was imported from tin mining regions in Africa and Malaya.

•

A NEW IRON ORE industry advisory committee has been set up by Office of Minerals Mobilization, Interior Department. It is the 15th such committee, formed to help work out long-range mining policies. The other 14 cover aluminum, antimony, asbestos, beryl, chromite, columbium-tantalum, copper, fluorspar, lead, manganese, mercury, mica, tungsten and zinc.

Labor This Month

MINE UNION CLASH IS COMING: The anticipated battle for control of bargaining rights in the non-ferrous mining industry is just around the corner. It will pit the Mine, Mill and Smelter Workers Union against the AFL-CIO Steelworkers. What has been hit-and-run skirmishing will turn into a full test. Mine-Mill will be on the defensive; the bargaining strongholds it has developed in the past 65 years will be challenged wherever there's a chance of success.

It's an unenviable position for MMSW. Past raiding attempts by the steel union have failed more often than not, but even then Mine-Mill has barely held its own. It stands little chance of recouping lost areas.

Too, Mine-Mill suffered a blow when the mutual aid pact it held with the AFL-CIO Teamsters Union failed to get off the ground. This had been anticipated as the way to revivify Mine-Mill's sagging forces, but the Teamsters never followed through on the joint organizing-economic pact. One big reason: Steelworkers' president David McDonald threatened trouble if the Teamsters went through with the deal. Another threat to the truck union was expulsion from the AFL-CIO for making deals with Mine-Mill in the face of the independent union's left-wing reputation and its expulsion 6 years ago from CIO for Communist domination.

With the Mine-Mill-Teamster pact dormant, Steelworkers' McDonald promises an all-out campaign to invade Mine-Mill territory. Without the Teamster's expected backing, the mine union's chances of escaping unscathed diminish considerably.

A 30-CENT WAGE DEMAND: That's the figure Mine-Mill officials set as the 1956 demand on the non-ferrous mining industry. They argue that productivity has soared in the industry while, at the same time, employment has dropped 17% since 1947. A 30c wage increase would help to make up the workers' share in the stepped-up output, as the union's bargaining strategy goes.

The plan is to seek the 30c either as a flat pay increase or split between wages and fringe benefits. Mine-Mill officials are not talking of "unemployment pay" or a shorter work week this year, despite last year's unfulfilled demand for a $75-a-week minimum pay. But, one big influence will be bargaining in the steel industry. The Steelworkers are planning a demand for overtime pay on weekends as well as a form of guaranteed annual wage. If they break through on either point in mid-summer bargaining, it could have a big effect on Mine-Mill. With the threatened raids, MMSW bargainers must get a good settlement.

POLITICS TO THE FORE: MMSW is revamping its political action programs for this year's elections. Every Mine-Mill local is being urged to set up an operating political action committee with the first goal to register every union member and voting age members of his family.

Beyond that, Mine-Mill will conduct an intensive drive for campaign funds to support favored Congressmen. Union officials plan to put Mine-Mill funds and personnel to work in 17 Senatorial and 75 House races, with emphasis in areas where the mine union is strong, and in the industrialized states. In addition to candidates, Mine-Mill plans a major legislative program, starting with a tax reduction for low income families, and running through school construction, Taft-Hartley, minimum wage, social security and so on.

NON-COMMUNIST OATH FLOPS AGAIN: The U. S. Court of Appeals has rejected, once and for all, an attempt by the National Labor Relations Board to crack down on the Mine, Mill and Smelter Workers. The NLRB sought a reversal of the Court's earlier ruling that the board could not withdraw its approval of Mine-Mill as a legal bargaining representative. The NLRB had charged that a Mine-Mill official had filed a false non-Communist oath and the union should be punished. But the court says, flatly, that the NLRB has no such authority.

Gardner-Denver... Serving the World's Basic Industries

NEW Super Portable Rotary · RP900DA

Delivery, cfm	900
Control	*New* Simplified Thriftmeter
Length	13′9″
Width	6′9″
Height	8′5″
Turning Radius	18′
Weight, dry	12,790 lb.

NEW Super Rock Drill · DH143

Hammer Diameter	5½″
Drill Rod Size	1⅞″ hex.
Weight, with crawler	10,500 lb.
Rod Change, up to	20′
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Length	11′
Width	8½′

NEW Gardner-Denver rock work team

Here's a new Gardner-Denver team for heavy-duty rock work in open cuts, in quarries, in open pit mines.

The new Gardner-Denver Rotary 900 Portable gives you extra air capacity for bigger drills or more of them —without additional engines and equipment to care for. Plus these popular Gardner-Denver features: clutch for easy cold-weather starting . . . circulating water system for warming up the compressor oil before it turns over . . . super-simplicity for easy field maintenance.

The new Gardner-Denver 5½″ Model DH143 gives you an entirely new rock drill class. Now you can select the proper bit size and plan hole spacing for best breakage in any ground. All controls are conveniently mounted at the operator's station. Available with a new Gardner-Denver air-powered crawler, or for mounting on your own heavy diesel tractor.

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THIS MONTH IN MINING (*Continued from p 73*)

Odlum Gains Ore Commitments

HOMESTAKE MINING CO. is reporting completing negotiations with financier Floyd B. Odlum which would lead to commitment of Homestake's three uranium orebodies in Big Indian District, Utah, to an Odlum-backed mill. The mill would be built in north end of the Big Indian District.

D. H. McLaughlin, Homestake president, confirms the discussions neared completion in talks in latter part of February in New York City.

It is his opinion that these discussions very likely will reach a satisfactory conclusion, McLaughlin said.

Homestake is now mining from the La Sal Mining and Development Co. and Little Beaver properties, both set up as operating affiliates of the big gold concern.

Centennial Development Co., is engaged in sinking shaft on Homestake's Alice Lease in north end of the district.

Odlum seeks the letters of ore committal as he enters the final phases of formal negotiation with AEC for establishment of the mill.

It is reported that Atlas Corp., which Odlum heads, will play the major role in the milling program. However, the concentrator, which might well turn out to be the largest built to date in the U. S., would be erected and owned by a new Atlas-associated company.

Likewise, a management group made up of prominent mining engineers and metallurgists is being assembled. This group will run the mill for the owners on a fee basis of some sort, it is believed.

Meanwhile, Odlum reportedly has obtained formal letters of ore committal from Hecla Mining Co. and Federal Uranium Corp., which share developments on the Radon mine. Letter from Hecla-Federal states that the Radon has an estimated 280,000 tons of proved uranium ore, averaging about 0.7% uranium oxide, it is said.

It is understood that the Odlum group is offering concessions on high lime problem afflicting most of the producers in the district. Terms of the concession are not known here.

Other orebodies which are within the Odlum sphere or directly controlled by affiliates of Atlas Corp. include the Daniel and Ruddock mine (Almar orebody); Cal-Uranium mine; Lisbon orebodies.

Negotiations have been carried on intermittently with E. L. Cord, whose group controls the Cord orebody, on which shaft is now being completed.

Actual tonnages committed or to be committed to the Odlum mill venture are estimated in the millions.

Should the Odlum group be successful in completing its deal with Mr. Cord and Mr. McLaughlin, then all the presently large reserves not pledged to the Uranium Reduction Co., which has an $8-million concentrator under construction, would be committed to the Atlas Corp. venture.

Some observers have expressed fear that should all Odlum-controlled ore in the Big Indian district be directed to the proposed mill, the Uranium Reduction Co. mill under construction at Moab, scheduled to start operation in midsummer, might encounter an ore shortage.

Lucky Mc and Utah Const. Propose Mill in Wyoming

FORMAL PROPOSAL to build a 750 tpd uranium mill in Wyoming's Gas Hills district has been laid before the Atomic Energy Commission by Utah Construction Co. and Lucky Mc Uranium Corp.

Announcement of the action came jointly from officials of both concerns.

Statement related that the facility would serve both the Lucky Mc Mine and other operators in the Gas Hills district as well as producers in the general Riverton-Lander area.

"Under the agreement between Lucky Mc Uranium and Utah Construction Co., the latter organization has been core drilling Lucky Mc claims during the past six months and developing sufficient ore reserves to support the proposal made to the AEC. Drilling and mining is still under way in the area. The deposits lend themselves to open pit mining after stripping the overburden," the statement continued.

"Pilot plant tests at Grand Junction Operations Office of AEC during January, February and March (1956) and laboratory work by Battelle Memorial Institute provided data on ore characteristics and process metallurgy. This work was directed by Utah Construction Co. in collaboration with Mr. Robert R. Porter of Salt Lake City, consulting metallurgist. While the ores differ somewhat from the general Colorado Plateau type of uranium, it has been demonstrated that the deposits are amenable to beneficiation and will prove an important source of uranium."

Bear Creek Plans Major Exploration at Tintic

BEAR CREEK MINING CO. proposes to spend several millions of dollars in exploration for nonferrous metals on properties of Chief Consolidated Mining Co. and Tintic Standard Mining Co. in the Tintic district, Utah.

(The figure has been placed, at Salt Lake City, at between $3-million and $8-million, and involves sinking a shaft.)

Report on the matter states that "For some months our company, together with Tintic Standard Mining Co., has been engaged in negotiating a unit lease agreement with Bear Creek Mining Co.

Report said that "this lease will involve our company's Apex and Water Lily areas, comprising some 3,000 acres and all of the Tintic Standard Mining Co.'s property in this area.

"It is anticipated that a satisfactory agreement will be consummated in the very near future wherein Bear Creek Mining Co. will furnish necessary capital and conduct the operations."

Iron Mine Development Will Begin Next Month

CONTRACT for construction of the processing plant at Steel Company of Canada's $16-million iron ore mining property in the Hull-Ottawa area, Quebec, has been let to Foundation Company of Canada. Pickands, Mather & Co., which shares a 50% ownership of the property with Jones & Laughlin Steel Corp. through its subsidiary, Bristol Quebec Mining Co. Ltd., is managing the operation.

FIRST SHIPLOAD of raw gypsum for processing at Kaiser Gypsum's new plant at Antioch, Calif. was unloaded in a domed, nine-story aluminum structure. Material came from Kaiser's quarries on San Marcos Island, Baja California via the 10,000-ton ore carrier, SS Harry Lundeberg. Storage building has steel frame, no supporting pillars. Other new facilities include: 950-ft dock; gypsum board products plant.

The Engineer's Report

CASE HISTORY

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FIRM *Bagdad Copper Corp., Bagdad, Arizona*

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246,000 POUNDS TOTAL LOAD, 48 tons of truck and 75 tons load, are hauled out of the Bagdad Copper Corp.'s ore pit at Bagdad, Arizona, by the two 350 h.p. supercharged diesels in this unit. RPM DELO Special Lubricating Oil is used in the engines as specified by Mr. Ernest Dickie, General Manager of Bagdad, on the basis of his years of experience with RPM DELO Oils in many other heavy-duty engines.

The big truck, described as the largest in the world, was designed by Mr. Dickie and engineers of Dart Truck Co., builders. Power is transmitted through 3-stage torque converters. All controls are powered.

FREE FOLDER tells you about all the RPM DELO Oils and how they meet every heavy-duty engine condition. Write or call for it today.

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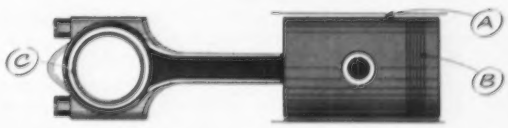

A. Contain special additives that provide metal-adhesion qualities...protect parts whether hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring sticking. Detergent keeps parts clean...helps prevent piston scuffing.

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Canada Permits Free Trade by Gold Mines

CANADIAN MINES may sell gold to private individuals for export or hoarding without restriction by the federal government following an announcement by finance minister Walter Harris, who presented his budget message in late March.

Officials immediately made it clear that the government move did not mean that Canada was returning to the gold standard; that is, holders of currency still may not turn it in and demand gold in return. The move means only that gold producers in Canada and elsewhere (if their local laws permit) are free to sell gold to any buyer who desires it.

Most gold produced in Canada since 1931, when she and other countries vacated the gold standard, has had to be turned over to the government at $35 per oz, U.S. In 1951, producers in Canada could sell to world markets if they forfeited the government subsidy to low-grade mines. Under the new ruling, they may sell to all comers, only reporting sales and production, and as long as they do not represent the gold as legal tender. Officials note that there is no intention to resume minting gold coins.

Reaction among major producers was comparatively mild, with most gold miners expressing surprise at the government move and approval of it as a step in the right direction. There had been no active agitation for a free gold market on the part of the miners, and none made any strong commitment to take advantage of the easement in any volume. Some observers thought the move reflected the stability of the Canadian dollar in foreign exchange, as well as the rather stable position of gold in world markets.

Lifting of export curbs could result in establishment of a Canadian gold market like those in London, Brussels, Paris, Tangiers, Hong Kong, Bombay and Beirut, but observers doubted that it would be effected, at least for some time. Informed government sources do not see the Canadian market as a counterpart to London's, and deem its creation unlikely because of the cost and volume of trading required to set up such an exchange. Neither is any volume hoarding expected, since that practice has been declining steadily all over the world.

Canadian production of gold in 1955 was about 4.5-million oz, worth $157.5-million. Last year's figure was 200,000 oz more than 1954, or $7-million.

Reason for the removal of restrictions was defined by officials as a move toward greater freedom of trading and elimination of "unnecessary controls." Government sources noted that they had checked with International Monetary Fund, of which all major western nations are members, and with other nations of the Free World and "nothing stood in the way" of the move.

CLIFF-HANGING is the order of the day at Golden Crown Mining Co.'s Orphan Claim, located 1300 ft below the south rim of Grand Canyon (*E&MJ*, February 1956, p 72). Snow has not interfered with operations, since drilling is conducted from an old copper adit.

Foote Mineral Acquires Electro Manganese Corp.

FOOTE MINERAL CO. moved in mid-March to acquire Electro Manganese Corp., Knoxville, Tenn., by exchange of stock on the equivalent of a share-for-share basis. Electro will distribute the shares to its stockholders.

Foote is a major producer of lithium chemicals (*E&MJ*, September 1955, p 75) and other ores, chemicals and technical metals. Electro, which will become a division of Foote, produces pure manganese metal, used principally in alloying steel, by electrolytic methods.

Gordon H. Chambers, chairman of Foote, noted that the acquisition of the manganese firm will augment diversification and secure "the services of a staff of engineers and chemists experienced in the field of electrochemistry."

Canada Extends Deadline For New Uranium Ore Purchases

A SIX-MONTH EXTENSION of Canadian Governmental purchasing of uranium ore from new producers has been announced by Trade Minister C. D. Howe, who said that new producers who can show they have an economic orebody and can enter production by Sept. 30, 1957 may get contracts.

Original deadline was April 1, 1957. Despite the extension, Minister Howe said he doubted total production would be "greatly in excess" of previous estimates. Canadian uranium is bought by Eldorado Mining & Refining Ltd., the government-owned company.

High Lime Penalties Are Revised by AEC

ATOMIC ENERGY COMMISSION has revised lime penalty schedules affecting uranium ore shippers to Moab and Monticello stations only.

New schedule provides that producers can elect to be assessed no penalty whatsoever if they will agree not to accept payment for vanadium or any other constituent metal.

(A couple of mines, the Happy Jack in particular, have copper in uranium ore.)

Shippers, of course, can continue to accept penalty. They are given the alternative as to which schedule they want on basis of their own profitable interest.

Criticism of the lime penalties in the Moab-Monticello districts has been severe, particularly since miners felt there was no reason for such penalties in view of advances being made in metallurgy.

Official statement of Grand Junction Operations Office of AEC recognizes these accusations.

"These new schedules are made possible by advances in uranium ore processing technology, particularly the development of carbonate leaching processes. For this reason, the high lime schedule is being limited to Monticello and Moab where plants with carbonate circuits are in operation or anticipated.

"While the schedules should work to the advantage of the majority of shippers to Monticello and Moab producing high lime ores, certain of these ores do, however, contain other constituents which adversely affect the ore's metallurgical characteristics. The Commission may from time to time issue special contracts to individual producers for the purchase of these ores with appropriate deductions to compensate for their higher treatment costs."

The schedules are as follows: Schedule I—Payment for high lime ores delivered to and accepted at the Commission buying station will be at the prices set forth in Domestic Uranium Program circular No. 5, revised, except that a deduction will be made of $1 per dry ton, plus 30¢ per dry ton for each 1% of lime in excess of 6% and fractions thereof.

(Uranium men insist this is the same schedule as now in effect at Moab-Monticello.)

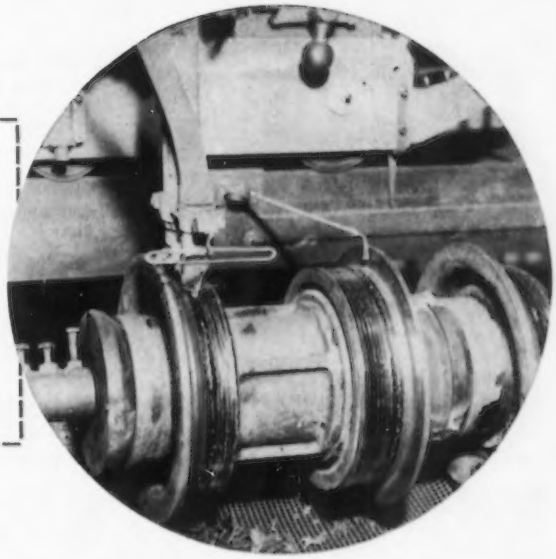
Schedule II—Payment for high lime ores delivered to and accepted at the Commission buying station will be at the prices set forth in the Domestic Uranium Circular No. 5, revised, except that no payment will be made for vanadium or any other constituent of the ore.

New Cuban Gold Mine

A NEW PRODUCER in the Las Villas province of Cuba is expected to begin production in mid-1956, according to Raul Loran, Cuban mining expert. Loran

Does it pay to

REBUILD TRACTOR ROLLERS?



here's one answer...

This is a report from one of the country's largest tractor maintenance shops having complete facilities for crawler reconditioning. It particularly concerns rebuilt track rollers, a major item of wear. In this shop rollers are regularly rebuilt and hard-faced by the automatic electric welding process, using Stoody 105 on the running surface and flange.

About a year ago a tractor came into the shop for overhaul. The rollers were badly worn; those found suitable for rebuilding were returned to size with Stoody 105 and the internal assemblies thoroughly reconditioned. The balance of the rollers were discarded and replaced with standard parts. Following routine procedure, the shop foreman checked the entire crawler assembly to insure proper alignment—*a highly important factor in reducing needless wear.* After 2500 hours this tractor came in again for its customary overhaul. Inspection of the rollers disclosed the following:

The standard rollers, without exception, were worn from 3/8" to 1/2" on the running faces; in all cases the internal assemblies required several replacement parts.

Hard-faced rollers showed negligible wear on running surfaces and the only replacements needed were new seals for internal assembly.

It is of course an accepted fact that rollers rebuilt and hard-faced with Stoody 105 by the automatic method give a service life considerably beyond that of standard replacements—at a much lower cost. The hard-faced roller with its superior abrasion resistance reduces uneven wear on the track rails by providing a smooth, even working surface that allows free movement of the rails and resists grooving of the roller. Hence, wear on the internal roller assembly is also decreased.

Stoody 105, the alloy used in this application, was the first automatic wire of its type and is today the alloy generally preferred by principal shops. It has been proven by eight years of actual field use—assurance of maximum service life at reasonable cost.

Earth-moving contractors operating large fleets of tractors, shovels, buckets and crushing plants often find the installation of an automatic welding head a profitable investment for rebuilding rollers, idlers, house rolls, crusher rolls and similar wearing parts. Many contractors, however, prefer to send such work to a thoroughly equipped automatic job welding shop of which there are a number located throughout the country. *A list of these job shops is available on request.*

Complete information on automatic hard-facing installations and procedures will gladly be supplied—without obligation. You may consult your local Stoody dealer—see the "yellow pages" of your phone book under "Welding Equipment and Supplies"—or write direct.

STOODY COMPANY

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See the STOODY EXHIBIT—WELDING SHOW, Buffalo, N.Y., May 9-11

Cuban Gold *(Continued)*

noted that work would begin as soon as necessary machinery is delivered. One "interesting" thing about the ore zone, he said, is that the gold is found with serpentine and not with quartz.

Chile Authorizes Plans For Copper Expansion

AUTHORIZATION for expenditure of nearly $60-million in expansion funds by U. S. copper companies in Chile has been approved by president Carlos Ibanez. Expansion will be undertaken by two subsidiaries of Anaconda Co. and by Braden Copper Co., a Kennecott subsidiary.

Andes Copper was authorized by one of the decrees to invest $52.9-million to bring into production its new El Salvador mine within the next five years. (El Salvador is the new name for the 78-million ton orebody at Indio Muerto, described on p 72, *E&MJ*, March 1956. Anaconda and the Chilean Government agreed to the change in name for the property, both agreeing that the property was indeed a "savior"—of the mining district, the local labor force, and the neighboring Potrerillos plant, whose supply source was expiring.)

Chile Exploration Co., the second subsidiary, will invest $1,050,000 in expansion of the Chuquicamata electrolytic refining plant, where refined copper will now be produced. Previously, blister was the major product.

At El Teniente, Braden will expend $1.9-million on its copper flotation plant. The government pointed out that these authorizations bring the total investment in Chile by the two copper companies in the interim following Chile's "new deal" legislation to $94,633,830.

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Field performance has amply proved these bits to be the driller's answer to **large hole** problems. They are made special, to your specifications and design, in any diameter; size and weight limited only by the handling capacity of conventional drilling rigs. They can be furnished to run on drilling stem or with integral rope socket top.

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Mining Calendar

Canadian Institute of Mining and Metallurgy, annual meeting, April 9-11, Quebec City.

American Zinc Institute and Lead Industries Association joint annual meeting. Statler Hotel, St. Louis, April 23-25.

Symposium on Rock Mechanics, sponsored by the Colorado School of Mines, Golden, April 23-25.

AIME Pacific Northwest Regional metals and minerals conference. Olympic Hotel, Seattle, May 3-5.

Uranium Ore Producers Assn. annual convention and exposition. Grand Junction, May 10-12.

Institute of Lake Superior Geology, Houghton, Mich., May 11-12.

Michigan Engineering Society, annual convention, Pantlind Hotel, Grand Rapids, Mich., May 11-12.

Industrial Nuclear Technology Conference, on uses of radioactive materials in industry, including radiation sources and nuclear instrumentation. Co-sponsored by *Nucleonics* magazine and Armour Research Foundation. Chicago, Ill., May 15-16.

11th Purdue Industrial Waste Conference. Purdue University, Lafayette, Ind., May 15-17.

Engineering Industries Exposition, N. Y. State Society of Professional Engineers. Statler Hotel, New York City, May 17-19.

Conference on the Physics of Nuclear Reactors, Institute of Physics, London, England, June 3-6.

Fourth annual Human Engineering Institute. Stamford, Conn., June 18-22.

Annual meeting, American Society for Engineering Education. Iowa State College, Ames, Iowa, June 25-29.

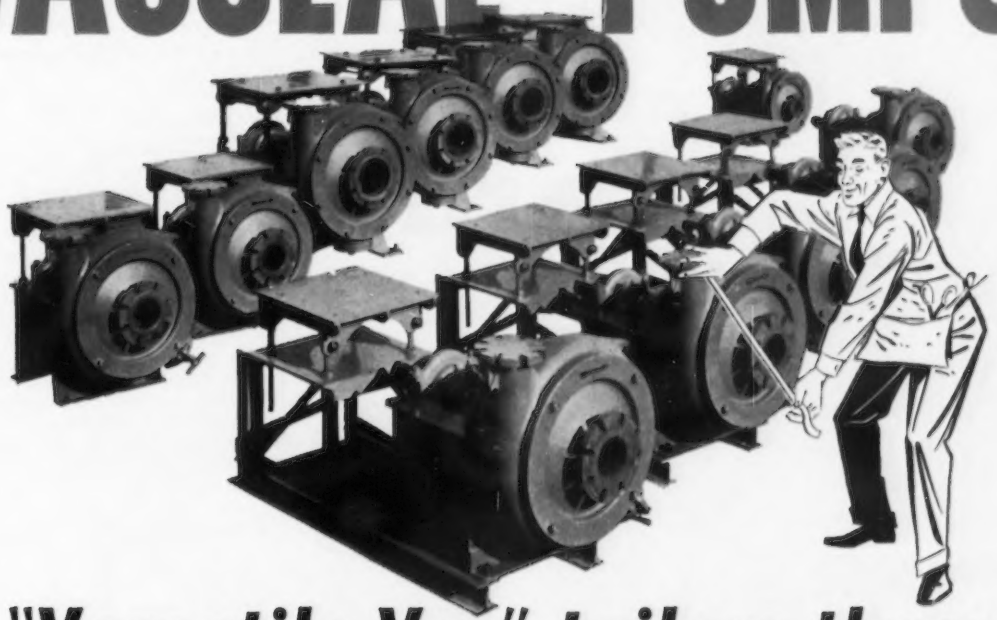
10th meeting, European Assn. of Exploration Geophysicists. Hanover, Germany, June 25-29.

Eisenhower Releases U-235

IN A DRAMATIC ANNOUNCEMENT in late February, President Dwight D. Eisenhower made available to Free World consumers of uranium 88,000 lb of U_{235}, to be taken from U. S. stockpiles and distributed one-half to U. S. power firms and the remainder to foreign producers.

Announcement by the Chief Executive said the allocation would take place over

VACSEAL PUMPS



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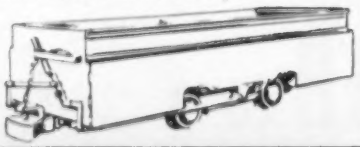
Thirty new Rotary Dump cars recently placed in service bring to an even 200 the CARD Rotary Dump Mine Cars now in underground use at Carlsbad. Potash does not give the impact punishment CARD cars are taking in so many hard rock operations, but conditions are still tough.

Trains are long; haulage distances constantly increase; grades grow steeper. To keep in full operation economically, the cars have to be easy rolling, strong of frame, and solidly built against mild corrosion. All wheels are Timken bearing equipped and live rubber pads are used instead of conventional steel springs. They are 152 cu. ft. in capacity, struck measure, and track gauge is 42".

Aside from a heavier draft gear to meet the requirements of steeper grades and heavier trains, today's cars are little changed from those in the original order. Four re-orders over a period of years prove customer satisfaction at International Minerals & Chemical Corp.

You, too, can customize your haulage with an economical CARD design. Our engineers can furnish an efficient car to meet your most difficult specifications.



C.S. Card Iron Works Co.

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DENVER, COLORADO

Eisenhower *(Continued)*

the next four decades and indicated that "additional allocations" would take place from time to time. He noted that the material would be "sold or leased" to the consuming nations.

Huge Aerial Mapping Program Underway in Saudi Arabia

NEARLY ONE-FOURTH of the kingdom of Saudi Arabia will be mapped from the air in a program to speed development of natural resources in the Arab nation. Survey, which is being flown by Aero Service Corp., Philadelphia, Pa., will map 200,000 square miles of the shield area of Saudi Arabia, believed rich in minerals.

Some 65,000 square miles have already been mapped, with crews working intensively to take full advantage of mapping weather. In April, the mapping organization reports, cloud formations will make their work impossible and the survey will shut down until September. Completion is scheduled for 1957.

Prospector Can't Mine Ore

EDWARD J. CHALMERS, Glenville, Conn., who found uranium ore on New York State lands near Peekskill in the lower Hudson Valley in 1953, has been denied the right to mine ore from his discovery by the Board of Commissioners of the Land Office.

Land is part of Camp Smith, a military installation. Board denied the application, explaining that "there is no immediate shortage of uranium" and that mining operations would disrupt the camp functions.

Cerro Offers Scholarships

CERRO DE PASCO CORP. has established a scholarship plan for one year of graduate study in the U. S. to graduate Peruvian technicians with a minimum of 2 years' service in CdeP employ. Robert P. Koenig, president, said three such scholarships will be awarded annually, providing transportation to the U. S. and return, full tuition, books and a liberal maintenance allowance.

Cities Service Seeks Uranium

CITIES SERVICE OIL CO. has entered the uranium field with purchase of an exploration lease from Texas National Petroleum Co. on the 110,000-acre Canon de San Diego grant in Sandoval County, N. M. Exploration crew, under Ernie Tisdale, will be at the site, 50 miles west of Santa Fe, "at an early date."

Alcoa Plans New Facility

ALUMINUM COMPANY OF AMERICA will construct a 150,000-ton per year smelting plant in the coal-rich Ohio Valley later this year, it is reported. With the new plant, Alcoa's primary aluminum capacity is expected to rise to 927,000 tons per year. Current capacity is about 777,000 tons. Announcement of the new plans

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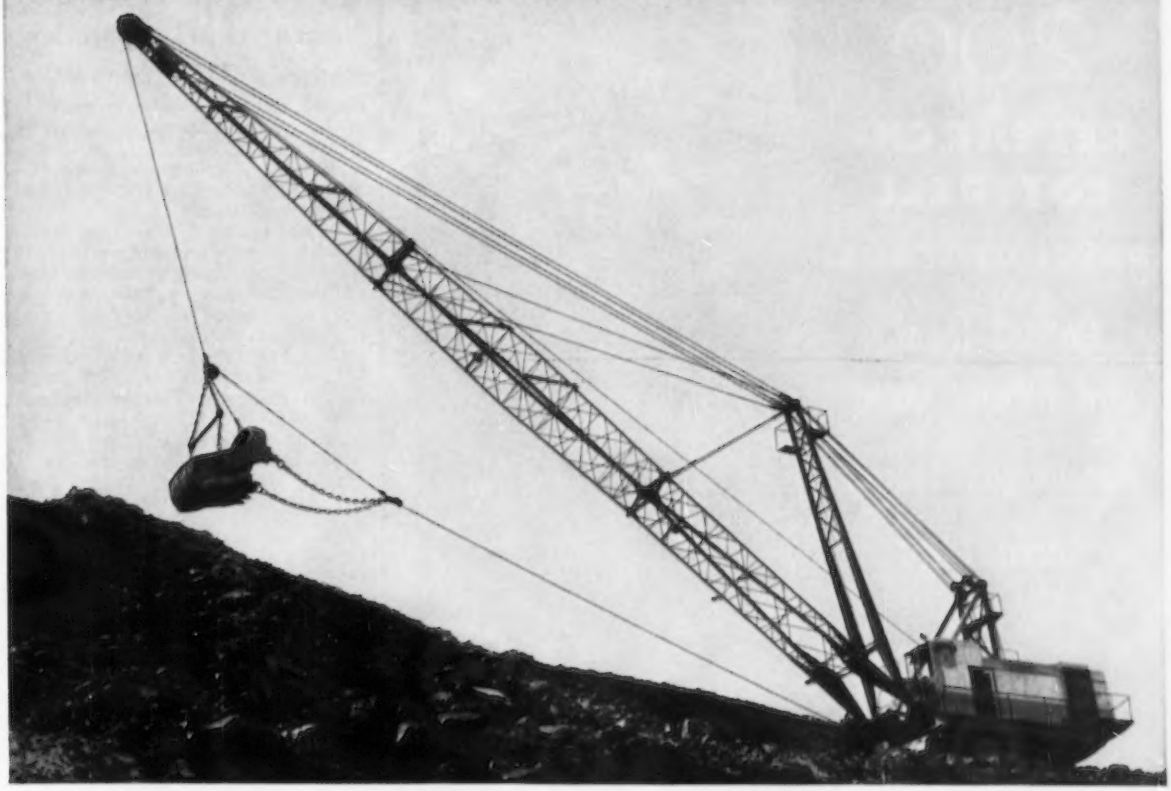


57% Longer Life with New VHS Dragline

Draglines take a real beating in the coal stripping operations of the C B & M Coal Company, Plains, Pennsylvania. Used for removing over-burden, the best Improved Plow Steel draglines lasted 525 hours. When new TRU-LAY VHS draglines were used they established service records of 825 hours—57% better than Improved Plow Steel.

Entirely New Grade

Mines all over the country are setting similar service records with new VHS. Made from a new grade of steel for wire rope—New VHS is at least 15% stronger than Improved Plow Steel, the strongest grade available before VHS. This means you can handle heavier loads with the same diameter line. And you get a higher factor of safety.

For Slusher Ropes, Shovel Hoist Ropes, Draglines

New VHS is also tougher . . . resists abrasion . . . cannot become "hide-bound" or lose its flexibility. Developed especially for use as slusher ropes, draglines and shovel hoist ropes, it stands up better in these toughest services.

Cuts "Down Time"—Saves Money

In addition to longer life, new VHS cuts costly "down time" of equipment for wire rope replacement. This can mean real savings.

At Your Distributor Now

Your American Cable distributor has draglines, slusher ropes and shovel hoist ropes of new VHS in stock now. Just call him and tell him the size and length you want. You don't need any complicated specifications.

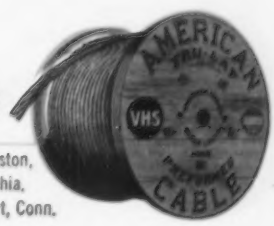
See your American Cable Distributor or write to the nearest American Chain & Cable Company Office

ACCO

American Cable Division

AMERICAN CHAIN & CABLE

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn.



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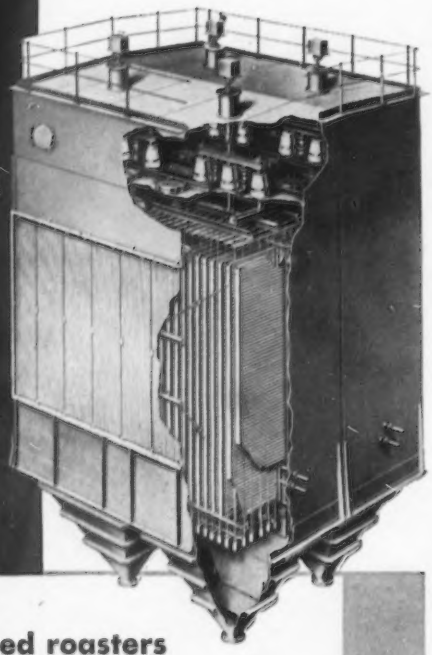
RESEARCH-
COTTRELL
PRECIPITATORS
Collect Dust
and Fumes from
Metallurgical Sources
Including:



- Fluid bed roasters
- Flash roasters
- Multiple-hearth roasters
- Reverberatory furnaces
- Converters
- Rotary kilns
- Electric furnaces

Bulletin GB describes in detail the construction and operation of Research-Cottrell precipitators. Write for your copy today.

RC-162

Research-Cottrell, Inc.

Main Office and Plant: Bound Brook, N. J.
405 Lexington Ave., New York 17, N. Y. • Grant Building, Pittsburgh 19, Pa.
228 N. La Salle St., Chicago 1, Ill. • 111 Sutter St., San Francisco 4, Cal.

Alcoa *(Continued)*

preceded acknowledgment that plans for a $400-million smelter near Skagway, Alaska, have been scrapped. Skagway plan, which company has considered for many years, was scrapped following reluctance by Canada to grant water power requests and a rise in freight rates for aluminum ingots.

Nicaro Nickel Operation Returns 24% to Owner

NICARO, one of the world's largest nickel producers, has returned its owner, the United States Government, 24% of its investment, according to Edmund F. Mansure, retiring head of General Services Administration.

Nicaro, located in Cuba, has been a bulwark in the Government's efforts to establish Cuba as a permanent commercial source of nickel, a vital defense commodity, according to the GSA report. Government's original capital investment, according to Mansure, was approximately $47.4-million. In the past four years amortization charges to the operating costs have totaled over $11-million.

Nickel production figures for the Nicaro plant as supplied by Mansure:

	Tons
1952	8,900
1953	13,850
1954	14,520
1955	15,150
Total	52,450

Estimated production for 1956 is already ahead of 1955's high level. At the same time production costs have been substantially cut. From an original powdered nickel oxide product, Nicaro has now progressed to a sintered oxide of higher content. Conversion to metallic nickel is the plant's next planned advancement.

Mansure explained the company's current expansion program scheduled for fall completion. Capacity is to increase 75% or about 25,000 tons. Nicaro's produced nickel market value will rise from $18-million to approximately $30-million.

Mansure emphasized that, "GSA is firmly committed to make every possible effort to dispose of this plant to private industry on a sale or lease basis as soon as there is a possibility of obtaining a fair value price for it."

Under contract with GSA, the plant is operated by Nickel Processing Corp. Ownership of the operating company is shared by the National Lead Co. (74%) and Fomento de Minerales Cubanos, S. A. (26%).

Selenium Exports Licensed To Meet Essential Orders

CERTAIN SELENIUM commodity exports were being licensed indefinitely by the Bureau of Foreign Commerce, U. S. Department of Commerce, as of March 1, 1955. Move will enable the United States to apportion limited available quantities to those countries with most urgent needs.

You'll find the Head Protection for YOU

. . . and for every job at

MSA
SAFETY EQUIPMENT HEADQUARTERS

M·S·A TYPE K SKULLGARD

The most popular and accepted work hat!

Tough, laminated plastic composition safeguards workers from every head hazard. Perfect balance, light weight, results in greater wearing comfort. Available in any of the lining styles illustrated below.

M·S·A TYPE B SKULLGARD

The Type B offers the best head protection available in cap-type style. Rigid peak, with reinforced beaded edge. Accommodates all linings shown below.

M·S·A COMFO CAP

Combining lightweight comfort with head protection, the M·S·A Comfo Cap is well-balanced, durable. Low crown designed for low coal mining. Accommodates all linings except Snap-in-Adjustable.

TYPE T ALUMINUM HAT

Light, cool and comfortable. Ideal for those desiring a metal hat. Tough aluminum alloy resists blows from falling or flying objects. Rigid brim protects face, neck, shoulders. Snap-in-Adjustable lining only.

TYPE T ALUMINUM CAP

This 9-ounce protector is die-stamped in one piece from tough aluminum alloy. Balanced for comfort, well-ventilated. Snap-in lining adjustable to any size.

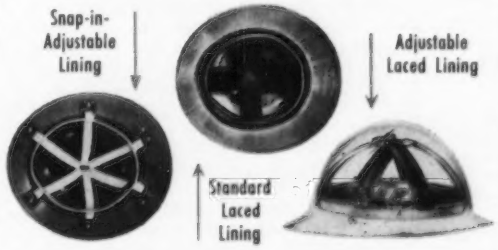
M·S·A SHOCKGARD

Head protection in electrical-hazard areas—from high voltage contact and falling objects. Meets EEI specifications. All plastic shell—no metal parts. Special Web Cradle straps; one-unit leather lining.

M·S·A GLASS FIBER HAT

High pressure molded, this hat provides perfect head protection. Smooth contours deflect falling objects. Snap-in-Adjustable lining. Available in stock colors—red, white, yellow, green, blue, gray, black.

A CHOICE OF LININGS, TOO



THE M·S·A LAMP BRACKET

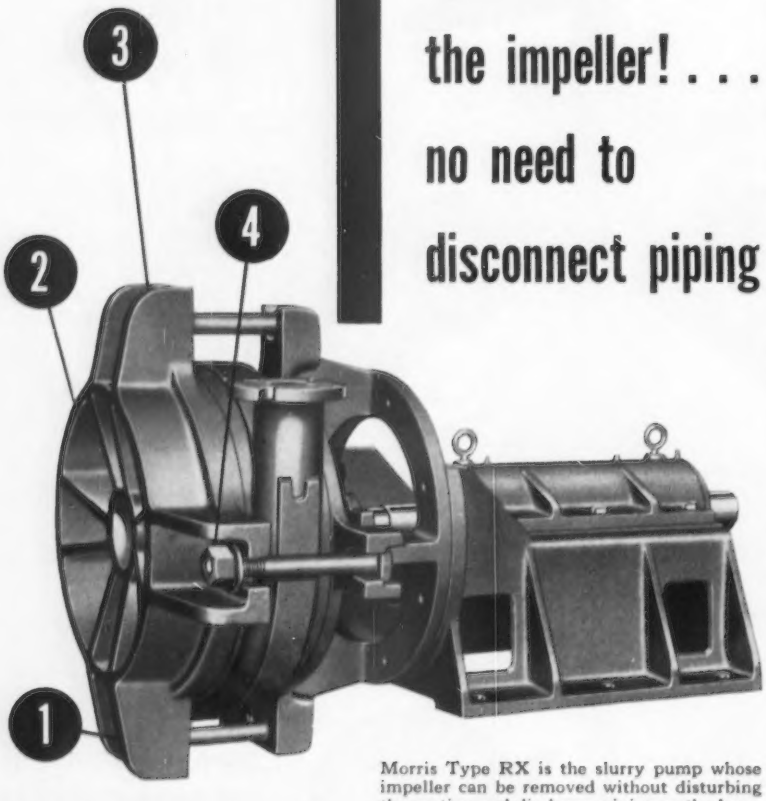
Designed for all Skullgards, this bracket positions the lamp accurately at all times. Molded of tough plastic, the bracket retains its shape under hard service, and is not affected by moisture or age.

M·S·A's complete line of hats and caps meets your every job, style, color, and lining needs. They are smart-looking, lightweight, comfortable, well-ventilated. They are designed for all service conditions, and individual preferences. They are rugged, durable. Your miners are safer, better satisfied when their head protection fits the job. Write for details.

MINE SAFETY APPLIANCES COMPANY
201 North Braddock Avenue, Pittsburgh 8, Pa.
At Your Service: 76 Branch Offices in the United States
MINE SAFETY APPLIANCES CO. OF CANADA, LTD.
Toronto, Montreal, Calgary, Edmonton, Winnipeg, Vancouver, Sydney, N.S. • Representatives in Principal Cities in Mexico, Central and South America
Cable Address "MINSAF" Pittsburgh

When you have a safety problem, M·S·A is at your service. Our job is to help you

Remove 4 Bolts and there's the impeller! . . . no need to disconnect piping



Morris Type RX is the slurry pump whose impeller can be removed without disturbing the suction and discharge piping or the bearings! To get at the impeller and renewable shaft sleeve, you simply loosen four outside clamping bolts—slip them out of disc slots—take off the end cover. Impeller unscrews from shaft threads; shaft sleeve is removed through end cover opening.

At no point do you have to dismantle the piping. Lay-up time costs are less . . . pump is back in service quicker.

MORRIS

TYPE RX

Slurry Pump

Write for specifications, capacities, performance charts, and other helpful information. Ask for Bulletin 185.

Use the Morris Type RX in Your Mining Operations

Morris Type RX is the product of nearly a century of experience in designing and building materials-handling pumps. It is specifically engineered to handle mixtures containing ore concentrates . . . tailings, slag and residue from filters and classifiers . . . all types of caustic or acid mixtures containing abrasives or solids.

MORRIS CENTRIFUGAL PUMPS

MORRIS MACHINE WORKS
Baldwinsville, N. Y.
Branch Offices in Principal Cities

Selenium (*Continued*)

The program stipulates first consideration for license applicants desiring to ship selenium materials for military use. Remaining amounts will be available for licensing to those countries which have in the past been dependent on the U. S. for a percentage of their requirement. In general, licenses for exports to countries relying on domestic production or import from countries other than the U. S., except in the case of military needs, will not be granted.

Selenium materials being processed in the U. S. from foreign-origin materials under conversion agreements are exempt from licensing.

The following selenium commodities are subject to licensing by the Bureau of Foreign Commerce: powder, metal, ferroselenium and selenium containing certain chemical compounds and pigments.

Utah Construction at Toquepala

UTAH CONSTRUCTION CO. with Morrison-Knudsen Construction Co. has won an $80-million contract for erection of power plant, concentrators and laying of railroad at Toquepala, Peru for Southern Peru Copper Corp.

M. S. Eccles, UC board chairman, said his firm would be sponsor of the project.

In all, Toquepala represents a $200-million plus venture on part of Southern Peru in which American Smelting, Newmont Mining, Cerro de Pasco and others have major interests.

Spanish Zinc Smelter

MINERA CELDRAN S. A., a mining firm of Cartagena, province of Murcia, has been authorized by the Direccion General de Minas to build a zinc smelter for blende processing. New installation would treat 40,000 tons of ore per year and the company hopes eventually to produce 18,000 to 20,000 tons of electrolytic zinc annually. Total costs of the plant, which will be run by Minera Celdran in cooperation with the Banco Central and financial groups from Bilbao, will amount to approximately 300-million pesetas ($7,500,000). Value of the imports required, including machinery and smelting furnaces is officially calculated at 33-million pesetas ($825,000). The zinc ore of the Celdran mines has so far been exported in order to be processed abroad.

French to Investigate Iron And Manganese in Africa

A FRENCH COMPANY has announced that it is to investigate the possibility of exploiting the manganese deposit near Franceville in French Equatorial Africa, which is believed to be the biggest in the world and the extensive iron ore deposit at M'Kambo. In the past, mining companies have been deterred by the difficulties of transporting ore from these deposits the 400-odd miles to the coast.

The company, the Societe d'Electro-Chimie, d'Electro a Metallurgie et des

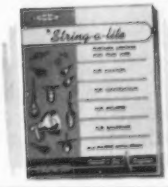
HERE'S 3-WAY PROTECTION AGAINST PRODUCTION LOSSES

You can't buy better Insurance against "downtime losses" caused by faulted power feeders and lighting lines . . . than JOY electrical connectors, portable lighting lines (String-a-lite) and cable vulcanizers provide. Designed by an organization which has been making this type equipment for Metal Mining needs for almost thirty years, these JOY products can be relied on to provide years of dependable, maintenance-free service.

Yours for the asking
WITHOUT OBLIGATION

BULLETIN B56 & B57
Provide complete information on JOY Attachable and Molded-to-cable type connectors.

ELECTRICAL PLUGS AND RECEPTACLES . . . More JOY electrical connectors are used in mining operations than all other brands combined. Factory molded as resilient Neoprene/rubber insulated units, they can't crack or lose shape when struck hard blows . . . are moisture and dust tight . . . and require no pampering to provide a long life of safe, efficient service. Hundreds of styles and sizes are available for mining needs. So for production's sake, remember JOY when you need electrical connectors . . . Bulletin No. B56 provides details. Ask for your copy.



BULLETIN No. B52
Twelve pages of illustrations and descriptions on JOY portable lighting (String-a-lite) and tool-outlet strings.

PORTABLE LIGHTING LINES (String-a-lite) . . . Require no special tools or talents to install or dismantle. Can be quickly lengthened, shortened or moved to meet the exact needs of any working or passage area. Supplied in one-piece factory molded sections of 2 to 10 light outlets that inter-connect through JOY male and female "end-plugs" to make up the complete string. Choice of five socket and two end plug designs. Mating power receptacles also available. Bulletin B52 provides complete details.

BULLETIN No. B48a
Describes and illustrates JOY's complete line of cable vulcanizers, molds and vulcanizing supplies.

CABLE VULCANIZERS . . . for rubber, Neoprene, Buna S and thermoplastic jacketed cables. Simple in operation, JOY vulcanizers quickly pay for themselves by making it possible to repair cuts and breaks in vital portable power lines immediately. Two types are available — "Steam" and "Direct Heat." Both are heated electrically with automatic temperature controls. Bulletin B48a describes these vulcanizers in detail and lists molds vs. cable sizes. Ask us for your free copy.

Consult a Joy Engineer

JOY MANUFACTURING COMPANY
General Offices: Oliver Building Pittsburgh 22, Penna.
In Canada: Joy Manufacturing Co., (Canada) Ltd., Galt, Ont.

JOY
Specialists in Creating Electrical Connectors for Mining Applications, Since 1928

CD 356.3

Yuba designed this screen for long life, minimum maintenance. Inner and outer screens easily renewed. Can be lubricated from outside.

HEAVY-DUTY SCREENS MADE TO FIT YOUR NEEDS

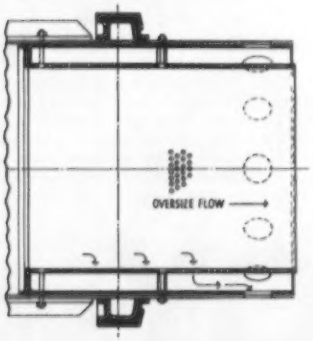
Flat or revolving • long-wearing non-clogging • competitively priced

—order from YUBA

For example – this double-jacketed screen, 35′ long and 8′ in diameter, washes and screens three sizes of sand simultaneously. Yuba-built screen plates are made from Abrasion Resisting Steel plates with a hardness ranging up to 250 Brinnell. This is a high carbon, high manganese alloy steel produced especially for screening purposes. In many places, screens of this tough, abrasion resisting steel last twice as long as ordinary screens. Naturally, this reduces downtime and replacement costs.

Yuba taper-drills screen holes to prevent clogging (unless you request straight sides). Holes can be as small as 3/16″ diameter; closely spaced for screening monazite sands and other rare earths. Thicknesses from 3/16″; length, diameter and other dimensions to suit your needs. Yuba screen plates are rolled true and cut square to close limits – insuring proper fit and fast installation.

Yuba stocks abrasion resisting steel in many thicknesses, usually can make prompt delivery. Try long-wearing, non-clogging Yuba screens now. For estimates, send screen details, hole sizes and spacing. No obligation. Wire, write or phone TODAY.



Yuba-built Olsen trommel increases screen capacity as much as 25%, by converting lower end blank shell plates into screening area . . . does not increase screen length.

102

YUBA MANUFACTURING CO.

Room 600, 351 California St., San Francisco 4, California, U. S. A.

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Manganese (*Continued*)

Acieres Electriques d'Ugine, has set up a local subsidiary with an initial capital of 1,200,000 French francs ($3,430) to study the possibility of establishing a ferromanganese company in Equatorial Africa.

The manganese deposit at Franceville is estimated to contain 100-million tons of rich ore. Open pit operations would be possible. Compagnie Miniere de l'Ogoue, in which United States Steel holds 49% of the share capital, is also investigating this deposit, but does not expect to begin commercial production before 1960.

The iron ore deposit at M'Kambo is being considered by Bethlehem Steel Co., which has taken a 55% interest in the operation, according to North American Mines.

IN THE U. S.

ALASKA

U.S. Smelting Refining and Mining Co. expects to operate two dredges in the Nome area this year and will build a third. A new hull will be constructed on which the machinery from the dredge that capsized two years ago will be installed.

A crew of men for USSR&M have started work at Hog (Hogatza) River to freight a dredge to the dredging ground at Bear Creek from the Koyukuk River where its floating journey ended last fall. Dredge was freighted to Hog River from Livengood where it was purchased from the RFC. Company officials hope to have it digging by next fall. The company plans to start six dredges in the Fairbanks area in the spring with a seventh to start late in the summer.

ARIZONA

Uranium Reserve Co., wholly-owned subsidiary of Sterling Uranium Co., Salt Lake City, has commenced shipments of ore to Shiprock mill of Kerr McGee Oil Industries Inc.

Settlement sheets on production from Uranium Reserve's Monument mine show receipt of 267,036 dry lb of ore running 0.25 U_3O_8 and 1.15 P_2O_5 and 271,954 lb running 0.35 U_3O_8 and 1.17 vanadium.

Monte Cristo mine and mill, located in Yavapai County, 12 miles northeast of Wickenburg, has been sold for $250,000. Dr. Norman Morrison sold to Northwest Development Corp., an Arizona corporation.

Cerro de Pasco Corp. of New York City has leased a 500-acre tract near Wickenburg. The copper company paid $250,000 and pledged 2½% of net smelter returns in a lease with Gregory Kennan, San Antonio, Tex.

Copper property includes 11 patented claims and 14 unpatented claims, all of 20

Why Thermoid Hose Lasts Longer

Mine operators everywhere find Thermoid Hose stays on the job longer—cuts replacement costs and down time. One big reason is quality construction. Another: Thermoid designs hose for specific conditions and uses. Here are three examples:

THERMINE — High pressure air hose. Oil resistant tube is reinforced by heavy duty yarn. Built on steel mandrels for high tensile strength. Smooth, abrasion resistant cover.

#325 S.B. SUCTION — Heavy duty hose for water suction service. Smooth bore, wrapped hose with heavy wire reinforcement, durable duck plies.

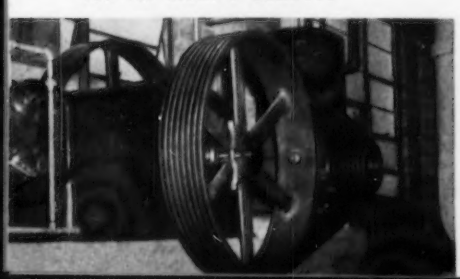
#300 AIR HOSE — Wrapped construction, oil resistant synthetic tube and covers. Heavy duck reinforcing plies. Ideal for use in mines and quarries.

These are typical examples of how Thermoid Personalized Service meets the specific, exacting requirements of the mining industry.

Thermoid

Thermoid Company
Trenton, N. J.

Make Thermoid your choice, too for Multi-V Belts . . .



. . . and Conveyor Belting, specifically designed for the job.

Your Thermoid Distributor can help you select the Hose, Conveyor Belting, Multi-V Belts designed to lower your operating costs.

SuperDuty® Table Performance is as Profitable as it is Dramatic

In a mineral concentration flow sheet, the SuperDuty table is unique.

In the mill, before your eyes, the most spectacular phase of operations occurs at the table because it is the only unit where the actual separation of mineral values is fully visible for appraisal.

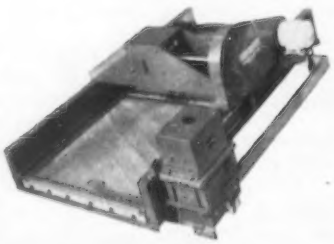
Here you see high grade concentrates produced with minimum loss to the tailings . . . and a greatly reduced volume of middlings for recirculation.

Whether you need one unit or a large battery, SuperDuty table efficiency is consistent . . . and easily ahead of that possible by any other table or process.

For full information, ask for Bulletin 118-B.

FOR SCREENING ECONOMY

All Leahy® screens provide differential vibration that snaps oversize wedging particles loose 1600 times per minute. When dust is a problem, totally enclosed models are available. For damp screening, FlexElex electric heating of the screen jacket insures full-time open mesh. For wet screening CONCENCO® spray nozzle arrangements are added.



THE DEISTER ★ CONCENTRATOR COMPANY

903 Glasgow Ave. • Fort Wayne, Ind., U.S.A.

CONCENCO PRODUCTS

★ *The ORIGINAL Deister Company* ★ *Inc. 1906*

Arizona (*Continued*)

acres each. The site is 8 miles northeast of Wickenburg.

Coring operations began March 1 on property held by New-Shat-Tex Corp. in the Four Corners area of Utah, Colorado, New Mexico and Arizona by Southern Geophysical Corp., which will build a camp for operating personnel on location, approximately 150 miles northeast of Flagstaff.

Contract with New-Shat-Tex calls for drilling 174,000 ft of core holes, each hole not to exceed 300-ft depth. Seismic shothole rotary drills will be used in the uranium exploration program.

New-Shat-Tex Corp., with headquarters in Grand Junction, Colo., is an exploration company owned jointly by New Jersey Zinc Co. and Texas Co.

International Metals Corp. has opened a $230,000 tungsten clean-up plant at Douglas, boasting the most modern plant of its type in the nation.

Six mechanical features are outstanding in the tungsten upgrading operation.

First are two new static ore separators designed and constructed by the mill superintendent, David McConnell. By using static electricity the tables can remove certain impurities missed by the magnetic separator.

Firm also has built its own two turbo mill pulverizers, a dry ore grinding process. Each of the grinders can handle three tons per hour and 75 tpd.

Plant will handle ore from Arizona, California, Nevada and Mexico. It has a capacity of 25 tpd concentrates. Bins are capable of storing 125 tons.

CALIFORNIA

George Kilmer, one of the original locators of the Miracle Mine in Kern Canyon, is doing exploratory work on the Tres Amigos claims west of Taft, Kern County. Kilmer put down some 8 holes, 20 to 40 ft deep, with a cesspool digger that cut 30-in. holes. He presently is deepening one hole to about 100 ft, reaming as he goes, preparatory to making a crosscut off bottom. Shale formation has proved very favorable for such drilling. Cesspool digger cuts some 225 ft of hole in about 6 hours. Cost was about 25c a foot. Shallow holes were logged by a small man who was lowered into the ground with a Geiger counter.

AEC has completed geological mapping of 24 sq miles of prospective uranium land near Ojai, Ventura County. Aerial surveys of the area west and north of Ojai are expected to continue to the end of March. Findings will be published in a geological report in the late spring or early summer. Numerous claims have been staked in the Ojai area, though no shipments have been made. Deposits are said to be somewhat similar to tertiary deposits in the Colorado Plateau country.

New Penn mine started producing and shipping ore from the 300 and 400 ft levels at an estimated rate of 50 tpd, according to announcement by H. S.

ELIMINATE TIME-WASTING DRILL STEEL CHANGES!

You can quickly interchange both TIMKEN® rock bit types on the same drill steel—right on the job

TIMKEN® multi-use and carbide insert bits eliminate the time wasted in going after a different set of steels whenever bit types are changed. Timken rock bits are interchangeable. Dozens of different bits fit the same drill steel. And it takes only a minute to unscrew one type of Timken rock bit and screw a different type bit on the same drill steel.

With Timken rock bits, your men can quickly switch to the most economical bit as the ground changes—right on the job. And because dozens of different Timken multi-use and carbide insert bits fit the same drill steel, you don't have to carry a large drill steel inventory.

Both Timken multi-use and carbide insert bits are made from electric furnace Timken fine alloy steel. And their special shoulder union keeps drilling impact from damaging the threads.

If you have a drilling problem, call our rock bit engineers. They'll be glad to help you. And there's no obligation. Just write: The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

WHERE YOU CUT COSTS WITH TIMKEN MULTI-USE BITS

Most economical for ordinary ground. With correct and controlled reconditioning, they give lowest cost per foot of hole when full increments of steel can be used.

WHERE YOU CUT COSTS WITH TIMKEN CARBIDE INSERT BITS

Give highest speed through hard, abrasive ground. Also most economical for constant-gauge holes, small diameter holes, very deep holes.

. . . your best bet for the best bit . . . for every job

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

SIZE
SEPARATE
DELIQUEFY
BEE-ZEE SCREENS
Tri-Rod, for knife-like separation
Round Rod, for long-lived accuracy
Grizzly Rod, for best features of round and tri-rod
Grizzly Rod with skid rod, for abrasion protection
Bee-Zee Screens are "sure-shaped"—their electronically precision welded rods have the **exact** cross-sectional shape your screening operation requires. That shape **makes you money!** For drier "deliquefying"...for greater accuracy and long life ...let Bee-Zee make screens tailored to your specifications. Bee-Zee Screens are 100% stainless steel ...can't rust, can't corrode. For complete facts, write or wire—or call us collect at Galesburg, Ill., 4397.
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546 Abingdon Street • Galesburg, Illinois

California (*Continued*)

Strouth, president of Standard Mining Corp. Ore is reported 10% Cu, with some gold and silver. Mine was acquired from Consolidated Goldfields recently.

Coso Uranium, Inc., Long Beach, is proceeding with underground exploratory work on 26 unpatented claims east of Haiwee Reservoir on the west flank of the Coso Mountain Range, Inyo County. Last December the company shipped four carloads, totaling 200 tons, to Vitro Corp. at Salt Lake City—largest shipment of uranium ore yet made from California.

Company is working seven men underground in three separate adits. Two of the inclined shafts go down about 60 ft, with crews drifting on bottom. The third shaft is a plain adit. Company is exploring one sizeable fault to see what relation it has to mineralization.

Company is running screen tests, stockpiling commercial ore preparatory to making additional shipments. W. Ormond Merritt, Long Beach, is head of Coso Uranium, Inc.

Management of Yuba Consolidated Gold Fields, Inc., one of the nation's top gold producers, has changed hands.

Pitman

B. F. Pitman, San Antonio investment banker who waged an unsuccessful proxy campaign last spring, took over Feb. 20 as president of the firm.

His faction was able to win control because last December the Bolster family—which managed the firm—put up for sale to the public a large block of Yuba stock held in a trust administered by the family. Proceeds of the sale of some 405,000 shares amounted to $1,368,000.

Pitman's first move as company head was to transfer the head office from Boston to San Francisco, near its operating properties. As president of International Mining Corp., an investment trust which holds 57,000 shares of Yuba stock, he had criticized Yuba's former officers for "absentee management" from the Boston office.

Surprise Corp., Taft, has applied for a DMEA loan to develop Surprise uranium claims near McKittrick, Kern County. A 40-ft open cut has been made on the claims.

Natomas Co., Sacramento gold dredging firm which has been casting about for diversified interests to invest in, has settled on a merger with a holding company: APL Associates.

Natomas will issue some $15½-million worth of its common stock to APL Associates in return for its assets: stock representing 46.7% of the common stock equity of American President Lines, the shipping firm.

Natomas will be the surviving company in the merger.

The multi-million dollar deal, approved by directors of both firms, is subject to approval of stockholders and regulatory bodies.

Rene Engel & Associates has been formed as a limited partnership to activate a tungsten mill on a 6-acre site near Weldon, Kern County, and develop 17 claims in the same area.

General partners are Rene Engel, South Pasadena, and Leo Legrand, San Diego. Limited partners have put up a total of $60,000 for the proposed operations. Claims to be developed include the three B & F claims, the four Last Chance claims, six Pala claims, and four Big Raymond claims.

COLORADO

Sale of the famed Schwartzwalder orebody near Golden—discovered about two years ago by Fred Schwartzwalder, 60, a high school janitor—has been announced.

The property, from which about 20 carloads have been shipped in part-time development work, was purchased by Denver-Golden Oil & Uranium Co. Price was not announced, but it is known Schwartzwalder had turned down other offers ranging up to $1.5-million.

Denver-Golden started mining its new acquisition immediately. Earlier shipments from the property included two carloads running more than 1% uranium oxide.

Atlas Uranium Corp. of Moab, Utah, began setting up its new lead-zinc-silver mill near Crested Buttes in Gunnison County, and president J. C. Burgess said the mill should be ready for operation by June 15.

Burgess said the 100-tpd mill is being erected so that capacity can be doubled if necessary, and that the company may do some custom milling as well as handling ore from its own properties.

Cataract Uranium Mining & Exploration Corp. announced early in March plans for developing the San Juan copper mine near Telluride. G. C. Ridland, Denver geologist, will oversee the development, the company said. A drift 100 ft below former workings which yielded an estimated 40,000 tons is planned.

A $75,289 contract for exploration of tungsten in Boulder County has been negotiated between DMEA and Reynolds Tungsten Corp., the DMEA's Denver office announced. Government's share is $56,467.

DMEA also announced a $24,852 contract with Price Exploration Co. for uranium exploration in Campbell County, Wyo., with Government participation amounting to $18,639.

Vanura Uranium, Inc., revealed early in March a 10-ton load of ore assaying 1.24% uranium oxide and 3.66% vanadium had been shipped from its Crown Prince mine on Martin Mesa, Montrose County. Ore came from a high-grade roll which crossed incline shaft being sunk toward drilled area.

Idarado Mining Co. announced it will dis-

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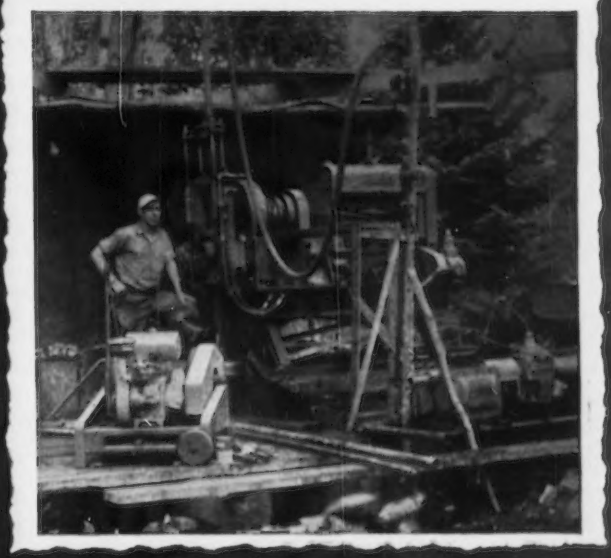

Longyear's Wire Line Core Barrel lets driller concentrate on good drilling techniques

Wire Line Core Barrel Shows *Better Results . . . Lower Costs*

Drill Runners Report 95% Core Recovery—No Back-Breaking Effort! How? By eliminating the need for pulling the entire string of drill rods. Longyear's Wire Line Core Barrel is out-performing conventional equipment, giving more footage per shift with less effort. Result: LOW COST! A recent field report disclosed only *one round trip* for the drill rods to obtain a hundred feet of coring at ten foot intervals. Ten round trips would have been required with conventional equipment. Another company reporting on Wire Line Core Barrel performance at depths of more than 4000 feet reported *saving 50 shifts—faster progress--better core recovery.*

The drillers' objective, RECOVERY OF CORE, is no longer a backbreaking chore. Freed from the difficult, time-consuming chore of frequently hoisting the drill string, "THE DRILLER NOW HAS TIME TO CONCENTRATE ON GOOD DRILLING TECHNIQUES." In a 3000-foot hole, total elapsed time from start of pulling core to resumption of drilling was recorded at *less than 33 minutes!*

Write for the Wire Line story today . . . a story of INCREASED CORE RECOVERY WITH LESS EFFORT—MORE FOOTAGE PER SHIFT—LOWER DRILLING COSTS—LESS CHANCE OF CAVING—LONGER BIT LIFE. Actual case histories of the use of this revolutionary diamond drilling tool in the field will be included with our bulletin.

Write for Bulletin No. 201

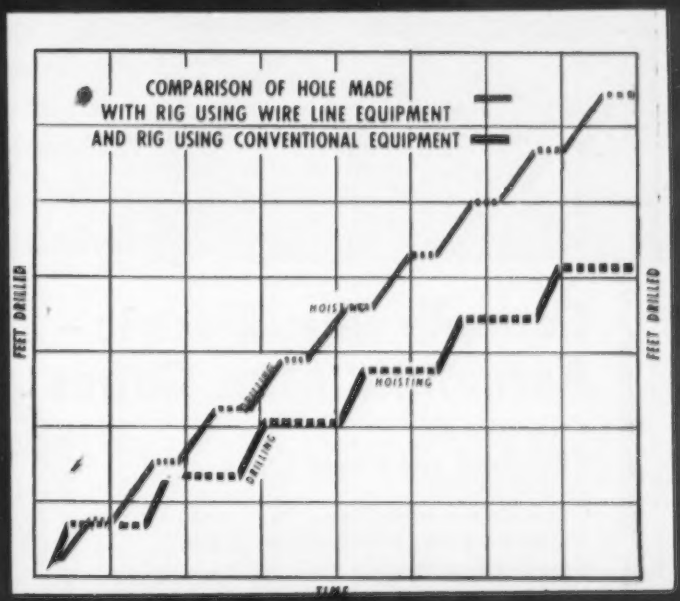

Chart shows advantages over conventional equipment which accrue in both SHALLOW and DEEP hole drilling

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Colorado *(Continued)*

solve Telluride Mines, Inc., which it has owned since 1953. Telluride Mines operation will be continued as the Pandora division of Idarado. John S. Wise, general manager, said the move will cut operating costs and improve efficiency through pooling of underground employees and dissolution of property lines.

Cresson mine at Cripple Creek is now free from water, having been drained by the Cresson lateral from the six-mile Carlton drainage tunnel, at a depth of 3,000 ft. During the past year, the main Cresson shaft was sunk 150 ft to the 23 level, with additional depth for suitable pockets. Development work on the 23 level disclosed an ore shoot 150 ft long, with more work yet to be done to get vertically under the ore shoots on the 22 level. Orebodies on the 22 and 23 are the largest that have been developed in the Cresson mine for several years.

Front Range Mines, Inc. has developed into one of the major gold producers in the state. In its Cripple Creek operations average value per ton during the past fiscal year was $70.07, an increase of $19.49 per ton over the previous year. Shipments since the close of the fiscal year amounted to approximately 2,200 tons with an average value of about $85, a further increase of about $15 per ton.

Ajax mine of Golden Cycle Corp. at Cripple Creek has been developing and mining on the Bobtail, Queen of the Hills and New Market vein systems on the 26, 27, 30 and 31 levels. Gratifying results came from the development on the 30 level on the New Market system where a stope 150 ft long was opened up with 285 ft of virgin ground over it. Preparations are under way towards sinking a winze below the Carlton tunnel level on high grade ore to ascertain its extent below the 31 level.

An armored car left Cripple Creek with the 283rd and 284th gold bricks poured at the Carlton mill of Golden Cycle Corp. since the plant's opening in 1951. The two bricks were valued at $78,500. Nearly 9,000 tons of ore was purchased by the Carlton mill for the month of January. Ore, which averaged $18.00 per ton, for the most part was mine ore, coming from the Cresson, Ajax, Strong, Grace, Greenwood, Deadwood, with a smaller percentage shipped from the El Paso dump.

Actual Shaft Bottom Installation

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IDAHO

Bunker Hill and Sullivan Mining and Concentrating Co. has asked stockholders to approve trimming down its name to Bunker Hill Co.

In a letter to stockholders, president John D. Bradley noted that the company is "far advanced beyond what is implied by the restrictive words 'mining and concentrating.'"

Bunker Hill mines and concentrates lead and zinc ores at Kellogg and Wallace and operates a lead smelter, electrolytic zinc reduction plant, and a sulfuric acid plant.

Bradley revealed plans to modernize the company's structure and operations. The program includes plans to consolidate the operations of Northwest Lead Co., Seattle, a 92%-owned subsidiary, into Bunker Hill as a sales and fabrication division.

Firm is moving ahead with preliminary outside work on its $7-million zinc plant expansion program as rapidly as weather conditions permit. Meanwhile the design department is perfecting plans for the big construction project, which will increase the zinc plant capacity from 4,800 to 6,000 tons per month of special high-grade zinc. Long-range plans call for addition of another 1,200 ton unit, bringing monthly capacity to 7,200 tons.

Nabob Silver-Lead Co. will start work this spring on the shaft-sinking program which was interrupted last August by a strike at its lead-zinc property in the Pine Creek area of the Coeur d'Alene District. An incline will be put down on the 500-ft-long ore shoot developed several years ago on the main adit level of the mine. Stoping operations have shown that the ore pinches out about 60 ft above the adit, but its downward projection has been proved by drilling to at least 200 ft. Drill holes show a 4-to-6 ft width of 20% zinc-lead ore at the lower elevation.

Lookout Mountain Mining & Milling Co., encouraged by the higher lead price, has

THIS TRAXCAVATOR* CAN LOAD OUT 450 TONS PER 8-HOUR DAY

THIS CAT* HT4 Traxcavator averages 350 to 450 tons of lead-zinc ore per 8-hour day, working 300 feet underground in a mine at Picher, Okla. It is one of 7 Traxcavators owned by American Zinc-Lead and Smelting Co. on the job. All the machines are equipped with air starters, and with exhaust scrubbers designed and built by head mechanic Bob Boyes.

Now there is a new line of Traxcavators, built to handle even more material at even lower cost. The No. 933 (1-yard bucket and 50 HP), the No. 955 (1½-yard bucket and 70 HP) and the No. 977 (2¼-yard bucket and 100 HP) comprise the new Caterpillar-built Traxcavator line.

These 3 new Traxcavators are compact, maneuverable and easy-handling. Their clean exhaust—thanks to efficient and trouble-free Caterpillar fuel injection—makes scrubbers practical for underground work. In all 3 of the machines, weight, horsepower and bucket capacity are perfectly balanced to give top efficiency and economy.

All 3 have these advanced Caterpillar features: 40-degree bucket tip-back at ground level for more leverage, less spillage. Extra-strong box section bucket arms stand up under heavy loads and shocks. Long-lasting oil clutch, which seldom needs adjustment and stands up to roughest duty. Conveniently placed controls and "built-in" operator comfort mean more production with less effort.

There's a Caterpillar-built Traxcavator, with choice of buckets and attachments to increase versatility, that will cut costs in *your* mine. Ask your Caterpillar Dealer for full details today.

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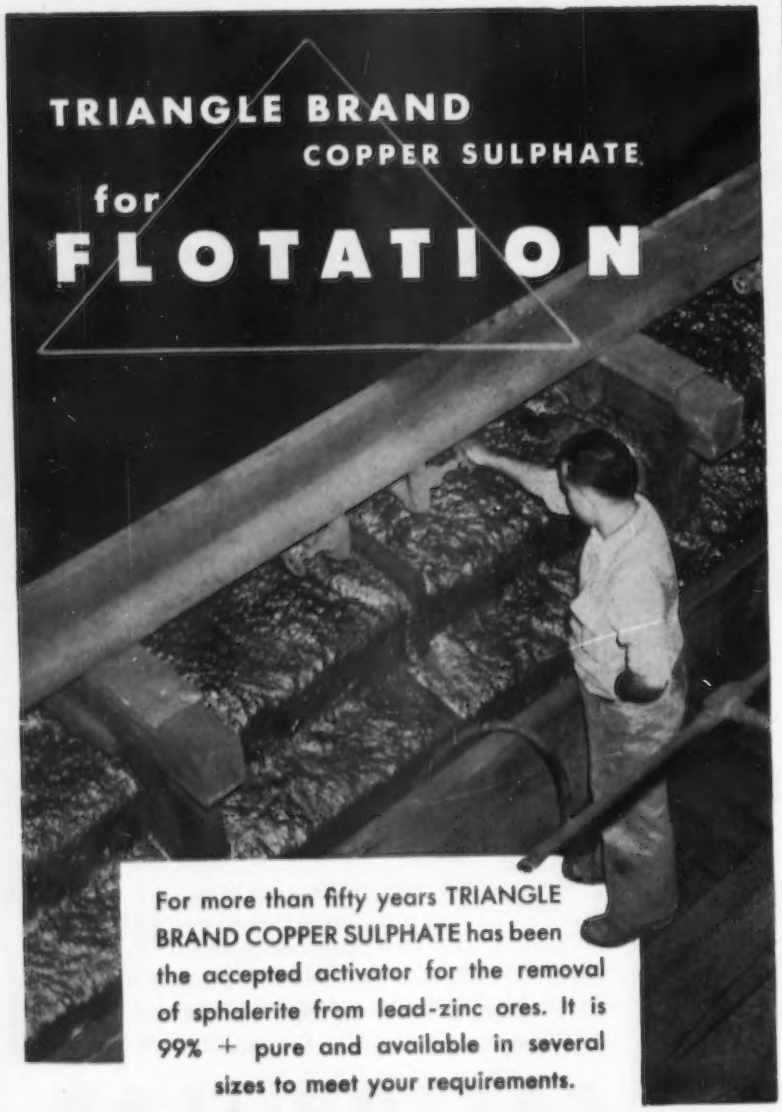
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Idaho *(Continued)*

resumed its search for the downward projection of the rich Lookout lead ore deposit at its property in the Pine Creek District of the Coeur d'Alenes. An east drift is now in progress along the shearing which was cut by the 1350-level crosscut from the Sunset Mines, shaft, toward the estimated position of the orebody on its easterly rake, as projected from upper workings which yielded very high-grade ore many years ago. The project is being carried out by Sunset Mines under contract.

Coeur d'Alene District mines, idled for five months by the strike of the International Union of Mine, Mill and Smelter Workers against the 16-operator bargaining unit, resumed operations promptly after the Feb. 1 strike-termination date and most producing properties were back in limited production within a few days. By the end of the month employment was back up to about pre-strike levels throughout the district. Day Mines Inc. reported 20% more hourly employees March 1 than in August 1955, when the strike was called, and American Smelting & Refining Co. reported full crews at all operations except the Galena, which was a few men short.

An inspection of the mines after the long shut-down by Mine Inspector George McDowell and his deputy, Ted Bush, showed little deterioration of underground workings.

Northwest Uranium Mines Inc., operating company for Eastern Lead, Fortune and Silver Buckle mining companies of Wallace and Pathfinder Uranium of Salt Lake City, announced recently that it has "farmed out" more than 100,000 acres of its vast uranium lease holdings in northeastern Washington and northern Idaho to Phillips Petroleum Co. for further exploration and development under a 50-50 profit-sharing agreement. The deal marks Phillips' first entry into the Inland Empire uranium field.

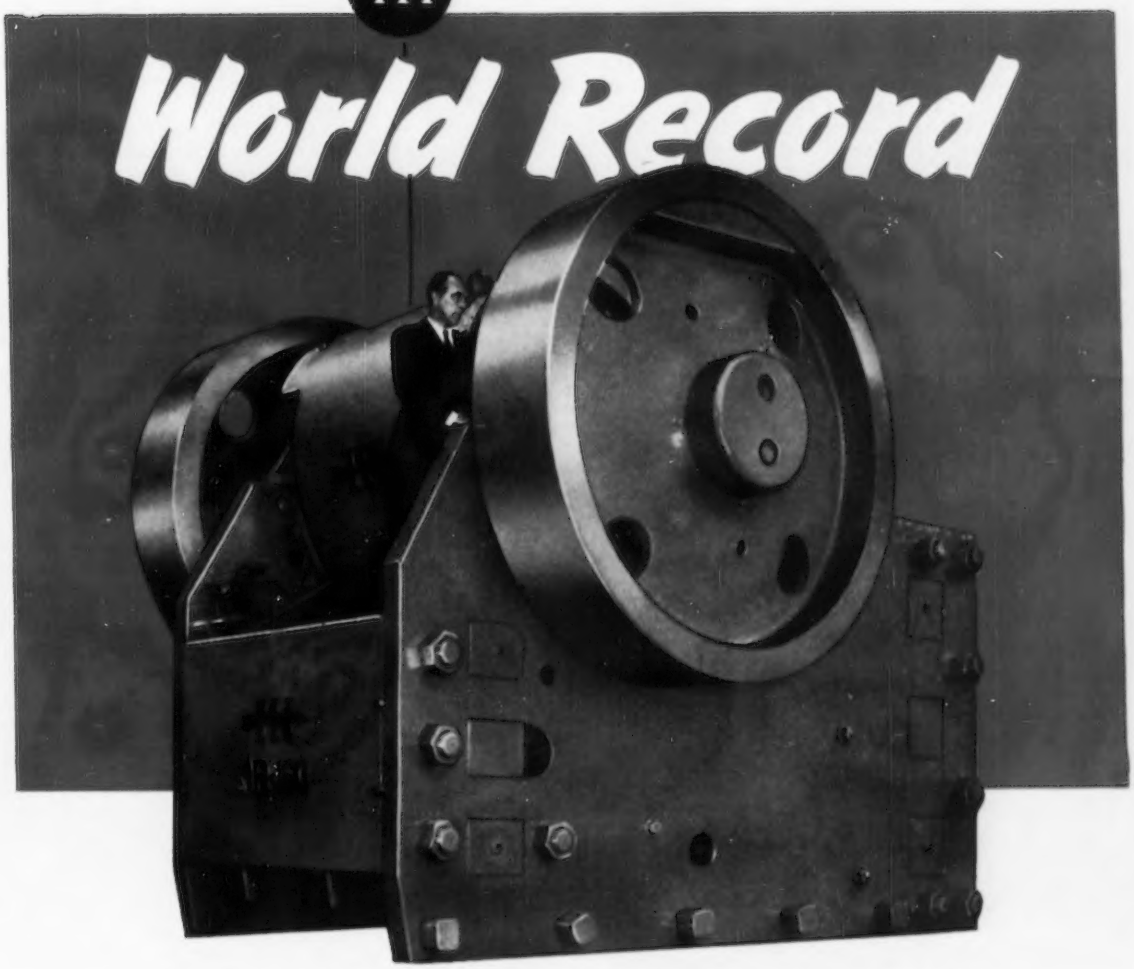
Northwest Uranium also disclosed that it has acquired prospecting permits covering a large part of the Navajo Indian reservation in New Mexico and Arizona and is concentrating its present exploration activities in the Ambrosia Lake area of New Mexico where important new uranium discoveries were made last summer by Sabre and Piñon Uranium companies.

At the company's Spokane Indian reservation prospect in southern Stevens County, Wash., commercial uranium mineral has been exposed through a zone about 1,000 ft. long by 500 to 600 ft wide by surface bulldozing, and a comprehensive drilling program to test the thickness or depth of the ore is scheduled to get underway as soon as weather conditions permit.

Application has been made to DMEA for a $53,000 Government loan for the drilling project, which provides for 12,000 ft of percussion holes for shallow tests and 1,500 ft of diamond drill holes for deeper probes. Chemical assays of three 50-lb samples of surface ore, made by the Atomic Energy Commission, showed

MAKE A NEW

World Record



Boulder Crusher AR-180

Six of these huge crushers are being supplied for use underground in Swedish iron mines at Kiruna and Malmberget.

The AR-180 with its 71" x 55" feed opening is the largest single-toggle type Jaw Crusher in the world. It can accept blocks of iron ore up to 10 tons and reduce these to 16" thickness. It can be dismantled into component parts suitable for transportation and erection underground.

Built in three sizes

TYPE	FEED OPENING	SETTING	MIN. MINE SHAFT DIMENSIONS	NETT WEIGHT
AR-120	47" × 35"	12"	36" × 73"	81500 lbs
AR-150	59" × 47"	12"	57" × 89"	170000 lbs
AR-180	71" × 55"	16"	60" × 98"	256000 lbs

Single-toggle design — simple and strong.
Frame in sections, with interlocked bolted joints.
Side frames for the AR-180 and AR-150 are of heavy steel plate.
SKF spherical roller bearings — grease lubricated throughout — avoiding oil leakage. Low idling power consumption.

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Idaho *(Continued)*

values ranging from 0.128 to 7.16% uranium oxide.

Conjecture Mines, Inc. now has projects underway at its Bonner County property near Lakeview that will permit an increase in production from 75 to 150 tpd by June 1. The 1½-compartment shaft is being enlarged to 2½ compartments, and it will be deepened an additional 200 ft to open a new 700-ft level. A 500-ft level was opened last year, and ore shoots had been developed previously on the 300 and 400 levels.

Hecla Mining Co.'s shaft-sinking project at the Silver Mountain Lead Mines Co. property in the Coeur d'Alene District east of Mullan got underway early in February and is being pushed on a three-shift-per-day basis, six days a week. Depth objective is the 2,080-ft level, from which extensive lateral exploration will be done. The million-dollar project is being financed jointly by Hecla and Bunker Hill Co. with the aid of a $529,183 DMEA loan, under a 75-25 profit-sharing agreement with the Silver Mountain firm. Hecla and Bunker share the larger share equally.

Metropolitan Mines Corp. has completed 120 ft of new raise work at the old Black Bear Mine on Canyon Creek near Gem, leaving about 230 ft to go to get above a stoping area worked by leasers during World War II and the Korean conflict. Area cannot be worked through old openings because support pillars were blasted out by the leasers.

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with cores you know what's below your rig — there's no guess work about formation depth, thickness or age because you are holding a sample of the earth's crust in your hand.

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MINNESOTA

Cleveland-Cliffs Iron Co. shipped 9,822,-179 tons in 1955 making it the fourth largest producer of the Lake Superior area. It is the only one of the major operators to obtain more ore from the Marquette Range—and from underground mines—than from any other range. Humboldt mine, concentrating low grade jasper ores, which made its first shipment of 153,738 tons in 1954, shipped 173,544 tons in 1955. Mine is owned jointly by Cleveland-Cliffs and the Ford Motor Co. Cliffs' largest producer was the Mather mine on the Marquette Range which made a record shipment of 2,787,268 tons in 1955, about 530,000 tons more than its previous record in 1953. Mather was the largest underground iron ore producer in the Lake Superior district—and in the U. S.

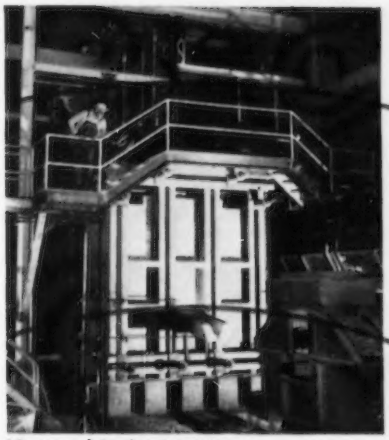
It has one shaft in Negaunee and one in Ishpeming, three miles apart. Output in 1955 closely approached planned ultimate production of 3-million tons per year. Cleveland-Cliffs' Marquette Range total was 5,684,698 tons as compared to 3,914,-537 tons from the Mesabi Range.

R. T. Elstad, president of Oliver Iron Mining Division, announced Feb. 16 that the Oliver has begun construction at Virginia of a large ore-sizing plant. Western Knapp Engineering Co. of Hibbing is working on the foundations and piling, after which the American Bridge Division will supply and erect the structural steel and install the machinery. Plant will treat only direct-shipping ores from Oliver's nearby Auburn, Rouchleau and Sauntry mines, Elstad said. It is expected to be ready for the 1957 season. In addition to the Virginia plant, the company will place in operation this year sizing units for the concentrates at four of its low grade ore beneficiation plants.

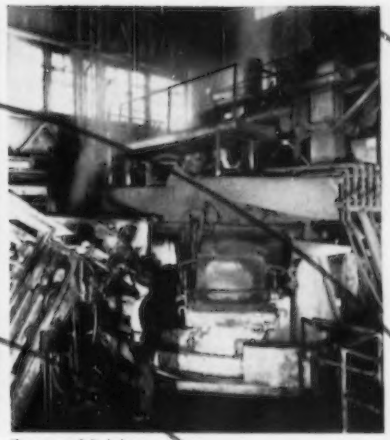
Another large ore sizing plant, similar to that at Virginia, is under study for the Hibbing-Chisholm district. Construction may begin next year. Object of the sizing plants is to separate coarse ore from fines before shipping as an aid to increased production of pig iron. Fines will be mixed at the furnaces with "ore dust and other metallics" and the mixture will be sintered.

M. A. Hanna Co.'s Parcel No. 3 mine near Coleraine, with the completion of its plant during the 1955-'56 winter, will be on Hanna's shipping list for 1956. Property contains an estimated 5-million tons.

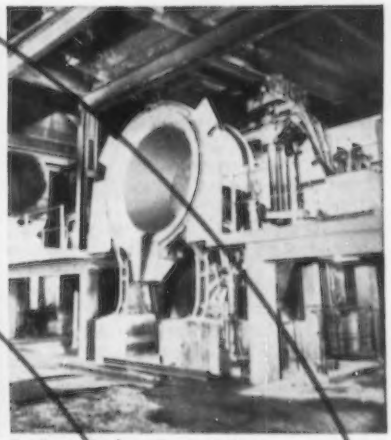
Oliver Iron Mining Division's shipments from the Lake Superior district for 1955 were 35,119,231 tons nearly equalling the combined shipments of M. A. Hanna Co., Pickands, Mather & Co., Jones & Laughlin Steel Corp., Oglebay, Norton & Co., Republic Steel Corp. and Inland Steel Co. The 1955 total exceeded 1954 by almost



Matte and Speiss Smelting



Copper Melting



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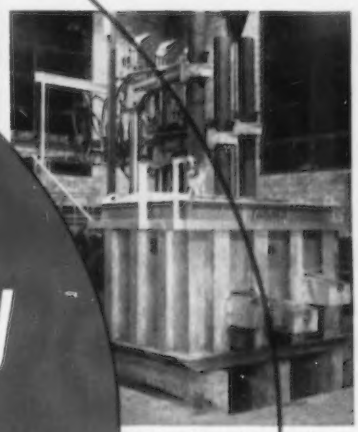
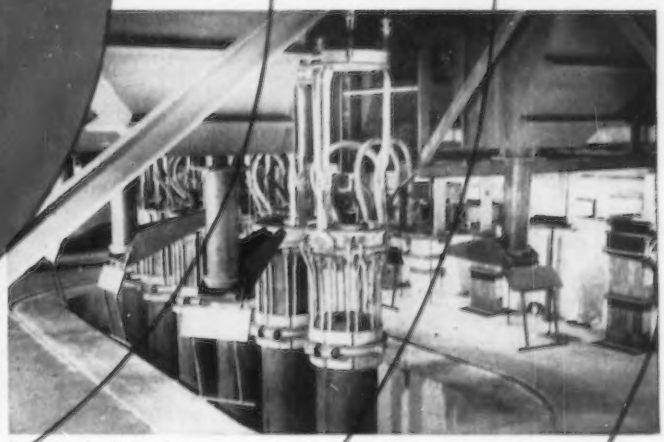


Pilot Plant Research

Ferro-Alloy Smelting



"Six-in-line" Smelter

*REG. T. M. U. S. PAT. OFF.

WHEN YOU MELT... MOORE RAPID *Lectromelt*

Minnesota (*Continued*)

10-million tons. Sherman group led with 6,382,955 tons followed by the Rouchleau group, Hull-Rust group and Monroe group. Plummer mine at Coleraine, which made its first shipment of 307,954 tons in 1954, had 2,191,969 tons in 1955.

There were ten properties which produced over 1-million tons each, all on the Mesabi Range.

Oliver's only Gogebic Range shipment came from the West Davis-Geneva underground mines which were recently leased to the Mauthe Mining Co. and are now operated by PM&Co. On the Vermilion Range it had the Pioneer & Soudan underground mines with a combined total of 1,057,985 tons. 33,931,235 tons of Oliver's 1955 shipments came from the Mesabi Range. The Hull-Rust group, which led all Oliver Mines by a wide margin for many years, in 1955 was in third place.

Reserve Mining Co. shipped 380,214 tons of taconite pellets in 1955 after first production in October. Silver Bay plant will operate through the winter, stockpiling its pellets for shipment in 1956.

Erie Mining Co.'s $300-million taconite project being constructed near Aurora has passed the half way mark. The construction crew reached a 1955 peak of 5,100 employees, with up to 3,000 at the plant site. The Hoyt Lakes townsite, which will contain more than 1,000 owner-occupied houses; the 73-mile railroad to Lake Superior with its docks and harbor and a large power plant at the harbor, provided employment for the balance of the big crew. Concentration plant, whose foundations rest on solid granite, will be almost ¼-mile long. It will have a capacity of 7½-million tons of 64% iron pellets per year. Some of the heavy equipment—several rod mills, a cone crusher, three switching locomotives and other equipment arrived before the end of 1955.

To meet the plant's great water requirements (approximately equal to one half that used annually by Cleveland, Ohio) the level of Whitewater Lake has been raised 30 ft. It will serve as a feeder for Colby lake which will supply the water directly. 90% of the water will be treated and re-used, remainder will come from the spring run-off caught in Whitewater lake.

It is expected that, during 1956, the harbor will be completed; a substantial portion of the milling plant finished, and track laid on the mine to harbor railroad. Operation of the plant is scheduled to begin during 1957.

First confirmed discovery of uranium in Minnesota was announced Feb. 4. Discovery was made by Norman Carlson near Angle Inlet, in the northwest corner of the state. Samples of the ore have been analyzed by the U. S. Bureau of Mines and confirmed as uranium.

Dr. E. W. Davis, former director of the U. S. Mines Experiment Station at the University of Minnesota, and now consultant for Reserve Mining Co.'s taconite plant at Silver Bay, addressed the Lake Superior section of the American Chemical Society and the Lake Superior Geology Club in Duluth Feb. 16. He advocated state-financed research aimed at utilizing Minnesota's low grade iron, copper, manganese, nickel and titanium ores.

He said that the University had used $1½-million in legislative appropriations since 1920 for taconite research, including the cost of the Mines Experiment building. The yields have already been $200-million through Reserve Mining Co. and an expected $300-million through Erie Mining Co.

Lake Superior Geology Club, organized late in 1955, held its first 1956 meeting at the University of Minnesota, Duluth branch, with about 35 members attending. First officers are: Dr. Robert L. Heller, head of the geological department at the Duluth branch, president; John Owens, Crosby, M. A. Hanna Co. geologist, vice-president; and I. L. Reid, Duluth, geologist with the Oliver Iron Mining Division, secretary-treasurer.

MICHIGAN

Cleveland-Cliffs Iron Co.'s Republic mine near Marquette on the Marquette Range, expects to be producing concentrates in April 1956. Construction on the pelletizing plant at Eagle Mills, about half way between Negaunee and Marquette, is progressing steadily. The strike at Westing-

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. . . can take abuse we mean. There's no place in the mining picture for a weak sister. Starting with an early rugged design, field experience has taught us how to make a tough car still tougher — an all welded steel structure intelligently designed for the savage loading conditions such cars have to endure. That's why they can take it!

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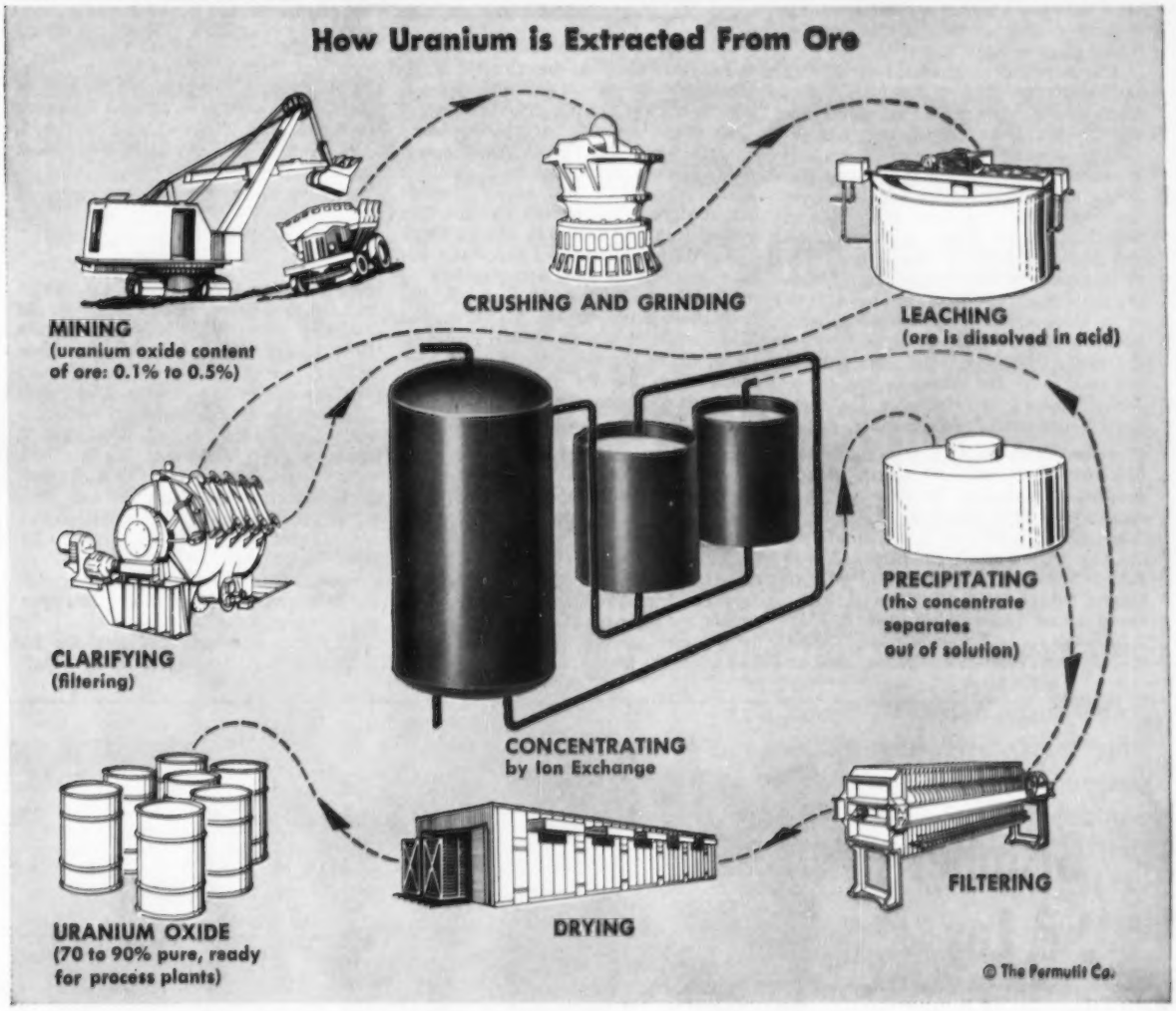

Ion Exchange Cuts Uranium Costs

One reason uranium is costly is because it's spread so thin. Even a ton of good ore contains only 10 lb. of uranium oxide. And when that ton of ore is dissolved, its 10 lb. of uranium is hidden in 5 *tons* of leach solution!

• **Solutions that dilute** would be almost too expensive to handle if it weren't for the ability of ion exchange to pick out "the needle in the haystack." Take the above example . . . ion exchange-precipitation takes the 10 lb. of uranium out of the 10,000 lb. of leach solution in one simple step . . . then delivers it in as little as 12 lb. of concentrate! It also discards other elements that generally stick close to uranium . . . eliminating special up-grading steps. The results: *more* uranium per ton of ore and at a lower cost than by former methods . . . and *higher grade* uranium that cuts subsequent refining costs.

• **That's why Permutit** ion exchange is at work at African, Canadian and U. S. uranium mines.

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Michigan (*Continued*)

house, which is furnishing some of the equipment, may delay its operation for some time. Gas Machinery Co. of Cleveland has been awarded a contract for installing a propane storage and propane vapor plant at Eagle Mills.

The Republic is scheduled to produce up to 600,000 tons of pellets per year. Cleveland-Cliffs, in its annual report, announced that in line with its policy of obtaining partners for its larger operations it has formed a company to lease the Republic and Empire mines and take over the ownership of the concentration and pelletizing plants. Four steel companies will participate in the new corporation, to be known as the Marquette Iron Mining Co. Cleveland-Cliffs will own 47½% of its stock and will operate the properties; Inland Steel Co. will have 20% of the stock. Jones & Laughlin Steel Corp. will own 15%; and Wheeling Steel Corp. 10%. International Harvester Co. (percentage not named) is a partner.

Cleveland-Cliffs Iron Co. with its 5,684,698 tons from nine Marquette Range properties, produced 86.89% of that range's total 1955 shipments of 6,542,370 tons. Inland Steel Co., from its Morris and Greenwood mines, had 6.38%; North Range Mining Co. had 2.32%; M. A. Hanna Co., 1.74%; all from its Richmond mine; Pickands, Mather & Co., 1.70% and Jones & Laughlin Steel Corp., 0.97% from its new Tracy mine at Negaunee. The Tracy will be a large producer in future years. 1955 was the Marquette Range's largest shipping year, exceeding the previous record year, 1942, by 1,639 tons.

As a result of archaeological expeditions to Isle Royale in Lake Superior, Dr. R. W. Drier, professor of metallurgical engineering at Michigan College of Mining & Technology, reports that charred wood unearthed in one of the old mining operations on the island dates back to about 2,000 years B.C. The ancient miners heated copper-bearing rocks with fire, then poured water on the rocks to split them.

Age of the old charcoal discovered was determined by the radioactive carbon 14 method in the Phoenix Memorial Radiations Laboratory at the University of Michigan under the direction of Professor H. R. Crane. Prehistoric pits have been found from the tip of the Keweenaw Peninsula to Ontonagon, 100 miles south.

Iron county mine valuations recommended by the state tax commission were increased $1-million above the 1955 figures. There were some decreases, the most drastic being on Pickands, Mather & Co.'s Buck group in the small city of Gaastra (its only mines) whose valuation declined from $690,000 to $235,000. Among the more prominent increases are: the Wauseca-Aronson of the M. A. Hanna Co., $665,000 higher; the Cannon, M. A. Hanna, nearly doubled to $1,015,000 reflecting the development of this new property; the West Hiawatha, also M. A. Hanna Co., raised $200,000; the Fortune Lake, Pickands, Mather & Co., $180,000 up; and the Bristol, Inland Steel Co., $65,000 and Youngstown, Inland Steel, $165,000.

E. W. Coons Co. is stripping the area of the old Wakefield open pit near Wakefield on the Gogebic Range which it has leased. The work is on a two-shift, 6-day week basis.

MONTANA

New Morning Glory Mining Co., which last fall took over development of the old Morning Glory gold mine in Lincoln County, near Troy, has opened a new orebody on the No. 6 level of the old workings. Ore was encountered in a drift which was being driven toward ore which had been disclosed by diamond drilling from the No. 4 level winze. The first 77 ft of the shoot averages 12 to 15 ft ore running $34 a ton in gold, silver and lead. At that point a fault was encountered and beyond the fault the ore widened to 23 ft averaging about $70 a ton.

Present plans are to continue the heading to its original objective and then open the new ore on the No. 8 level.

The firm was organized by John H. Stevenson and Associates, Seattle engi-

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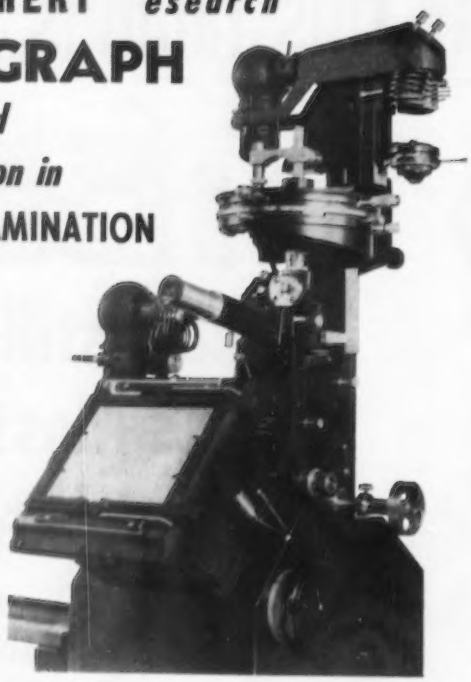

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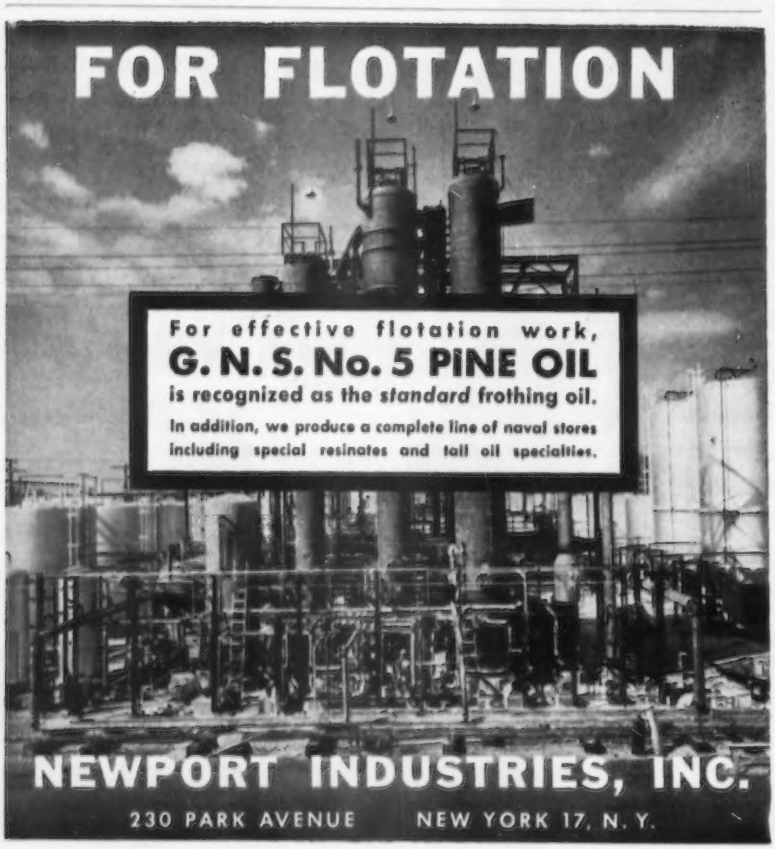
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Montana (*Continued*)

neering firm, last fall after the group had purchased the assets of the old company from C. W. Thornton of Troy. Raymond C. Smith, Seattle consulting engineer, has been directing the new development program.

First shipments of iron ore from the Running Wolf district, 12 miles south of Stanford in Judith Basin County, will be moving toward Duluth by midsummer, according to Paul J. Murphy, Stanford attorney and Montana legal representative of the Young-Montana Co., developers of the Running Wolf ore deposits.

"Preliminary work such as clearing the site of the open pit mine has been done," Murphy said. "Drilling of test holes is now under way."

Murphy said Great Northern Railway crews have made a survey for a spur track to handle the iron ore shipments. Ore will be trucked from the mine for about 10 miles to spur track, there loaded into gondolas and shipped to Duluth. At Duluth, the ore will be loaded into Great Lakes freighters for shipments to steel mills at Cleveland, Ohio.

E. A. Young of Hibbing, Minn., is president of the Young-Montana Co., which was incorporated last October. Joseph Lovallo, Duluth, is vice president, and A. M. Clure, also of Duluth, is secretary of the company.

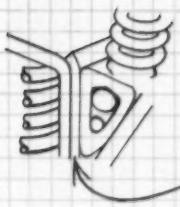
Murphy said several miles of road will be built to link the mine with existing county roads leading toward the head of Running Wolf Creek. Several bridges will have to be strengthened to accommodate the heavy ore trucks.

Young and Lovallo visited the Running Wolf area several weeks ago, and are expected to return to Montana from Minnesota in the near future. Young estimates the Running Wolf ore deposit at 1-million tons of ore. Ore is of the Bessemer lump type, averaging about 60% natural iron, he said.

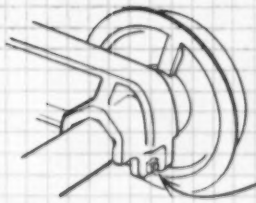
NEVADA

D. E. Sayre, general superintendent of the Toy Mill organization in Pershing County, announced that 22 men are now employed in mining, milling and construction work for the tungsten firm. Two mines are being operated. One, the St. Anthony, 20 miles west of Lovelock, employs two men and the Starlight in Humboldt Canyon employs four. A 100-ton mill is being operated by 12 men on the edge of Humboldt sink at the railroad siding near Highway 40 and the Southern Pacific tracks. Ore is crushed and screened into fines after which it passes over six concentration tables which produce concentrates of about 40%. Ore is all scheelite.

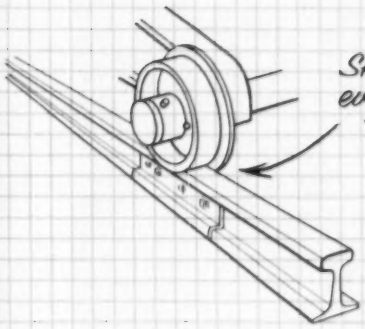
Sol Polsner and associates, of Hollywood, Calif., have several men employed at a copper deposit 3 miles west of Black Mountain in Mason Valley. Group recently took possession of 400 acres of claims from Cecil Hansen on a cash and royalty basis, and now have two large tractors and other equipment on the property. Ore is said to run as high as 17%,



Movement between bolster and side frame is taken on specially designed wear surfaces

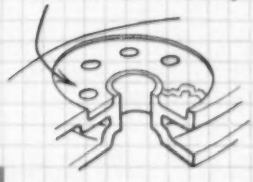


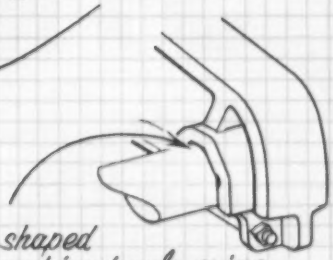
Quick wheel change



Smoother ride even on rough tracks

Large center bearing for longer life





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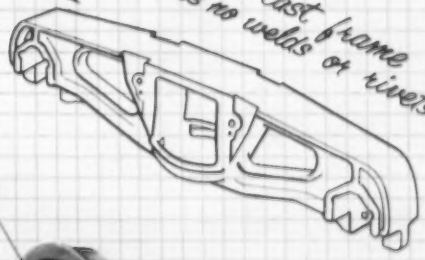

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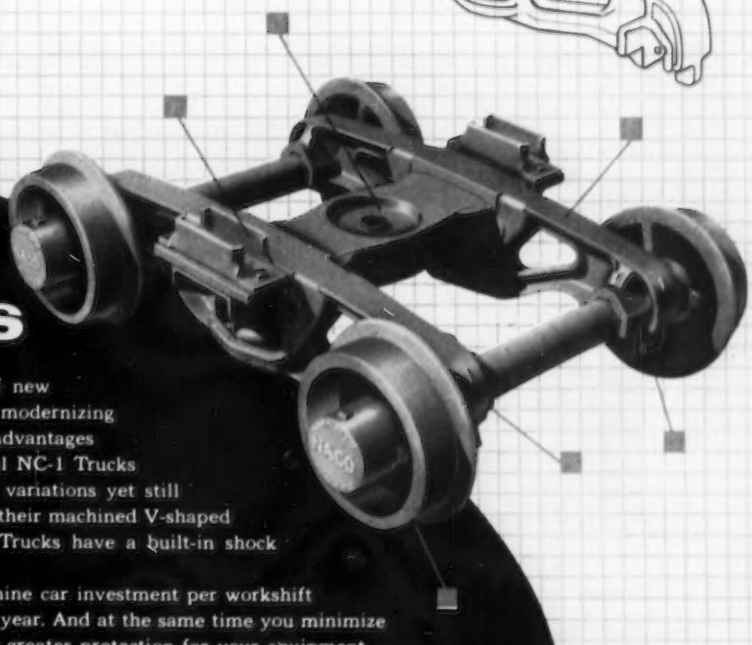

If you're considering the purchase of new 8-wheel mine cars . . . or if you're thinking of modernizing older cars—*now* is the time to check the advantages of National NC-1 Trucks. National NC-1 Trucks have controlled flexibility for track variations yet still maintain truck alignment through their machined V-shaped axle grips. In addition, NC-1 Trucks have a built-in shock absorbing mechanism.

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Nevada *(Continued)*

and a 500-ton mill is to be erected if showings continue favorable. A tunnel 50 ft in length with a 40-ft winze is on the property from which ore was dug nearly 50 years ago when the Wabuska smelter was in operation to handle the output. Polsner operates a chain of motels and lodges in southern California in addition to his mining operations.

Coast Mining and Development Co., mine development contractors, of Oakland, have announced plans to establish a pilot mill and testing laboratory at Yerington and a recovery mill in Gabbs Valley as soon as weather permits. The pilot mill has already arrived in Yerington. W. L. Stuart, president of the firm, says that native quicksilver, gold and platinum are the principal values represented on the 2,560-acre tract which the firm plans to develop. Stuart, formerly of Rawhide, Bullfrog, Goldfield and Tonopah during bonanza days, has completed exploration and research work in the area in company with his son, C. L. Stuart.

Apex Uranium Co. made the first shipment of ore from its mine near Austin during February. Ore was taken by trucks to the Vitro Mill in Salt Lake City. Other ore, running under 2% U_3O_8 is being stockpiled for future shipment by rail freight from Battle Mountain. The ore bin, 20 ft high and 70 ft long, has been completed, and work has started breaking ore in preparation for the shipping program. Ore stored in the bin will be high grade.

Nevada Scheelite Corp., one of Nevada's major tungsten producers, is employing 150 men at its mine and mill in northern Mineral County. Mill, which uses gravity concentration and flotation, has a capacity of 150 tpd. At the mine a three-compartment shaft has been sunk to the 400-ft level from which a winze extended to the 500-ft level is now being deepened to 600 ft. Mill recovery averages one unit of tungsten per ton, and the ore is maintaining its grade at the 500-ft level. Stopes vary from 8 to 14 sets in width, and the square set system of mining with subsequent fill is employed. In addition to milling crude ore, the company has a mill for processing tailings resulting from a prior operation. The latter mill is at Dead Horse Wells, nine miles south of the main installation. Tailings are reground in a Marcy mill and then floated. The concentrates are hauled to the milling plant at the mine and upgraded in the acid plant.

George H. Snyder, president of Bristol Silver Mines, Inc., announced that leaser Jack Buehler, Pioche, Nev., has encountered what may be a "substantial orebody" of lead-silver-zinc ore at firm's property in Pioche District.

Discovery on the east sector of the mine's 500-ft level has yielded six cars of fluxing ore which were shipped in recent weeks to Tooele, Utah, smelter of International Smelting & Refining Co. (Anaconda Co.) Settlement was $3,400.

Mr. Synder said the cars ran 27.7 oz of silver; 6.6% copper; 4.5% lead and zinc, respectively.

Leonard Anderson, underground electrician, Polaris Mining Co., Wallace, Idaho

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The photographer who took this shot agrees with Mr. Anderson about conditions at this fan. After bringing his cameras into this part of the mine, it took half an hour before they were free from condensation and could be used.

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Nevada (*Continued*)

Raising on the ore is now under way. Bristol shares 50-50 in the properties leased to the Werner interests.

NEW MEXICO

Merger of Sabre Uranium Corp. and Pinon Uranium Co., Inc. into the newly created Sabre-Pinon Uranium Corp. will be acted on by shareholders of the firms April 17.

Stockholders also will be asked to approve a proposed contract with American Metal Co., Ltd., extending through 1962 which would give that firm operating management of Sabre-Pinon.

American Metal would obtain 25% interest in the new company.

Hugh M. Craigie, Santa Fe, Sabre president, said a 1,500-ton uranium mill would be built near Grants to serve Ambrosia Lake discoveries.

American Metal would operate the facility.

Sabre stockholders would receive one share of Sabre-Pinon for each two held. Pinon shareholders would exchange on a one-for-one basis.

Meanwhile, discoveries by the companies in the Ambrosia Lake area have raised legal complications.

Henry Bigbee, attorney for Sabre and Pinon, has obtained at Albuquerque an injunction from Federal Court Judge Waldo Rogers prohibiting G. P. Roundy and Forrest H. Ives from prospecting on two sections of land in McKinley County, N. M.

Bigbee produced a 25-year-old order of ex-President Herbert Hoover temporarily withdrawing from entry under homestead or mining laws some 1-million acres of public domain in northwestern New Mexico and Arizona.

The lands were withdrawn in anticipation of Congress attaching them to the Navajo reservation. This was never done, apparently, nor was the order ever rescinded.

Bigbee claims the lands and minerals rights are privately held. The prospectors say the domain is still open to the public.

Officers of United Western Minerals, Inc. disclosed in Denver the company has received four separate proposals for construction of a uranium processing mill on the firm's uranium ground in the Ambrosia Lake area 26 miles north of Grants. Alva Simpson of Santa Fe, president of the company, says United Western has under way a $130,000 exploration program to determine exact size of the firm's orebody there. He said the orebody is so impressive that four firms have approached United Western with proposals for consideration of a mill. The companies, he said, are Climax Molybdenum Co., Golden Cycle Mining Corp., Kerr-McGee Oil Industries, Inc. and the Rio Del Oro Uranium Co. All four propose to build and operate the mill in cooperation with United Western, says the official.

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NORTH CAROLINA

Carolina Mines, Inc., a newly-formed corporation, expects to begin operations at a kyanite deposit between Kings Mountain and Crowder's Mountain in mid-May. A processing plant to handle 40 tons per hour has been constructed at the site which has indicated ore of more than 3-million tons, it is reported. Officers of the new company include: A. S. McCullock, president; J. E. Herndon, president of Rogers-Smith Co., Inc., vice-president; and Peter E. Peterson, secretary and managing engineer.

Lease agreements to two groups for the exploration of tidal sound and river bottoms in eastern North Carolina for ilmenite, have been approved by the N. C. Council of State.

One of the agreements was with Graham D. Monroe of Coral Gables, Fla., and the other was with W. H. Rodenbeck of Morehead City, N. C., and Eli Perry of Kinston, N. C.

The two groups were given three-year prospecting leases for parts of Albemarle Sound, Pamlico Sound, Pamlico River and Chowan River, but the leases do not give the right to mine the areas. Further approval would have to be granted to mine any suitable deposits discovered.

Practically all of the Pisgah National Forest land in Burke, Avery, Caldwell and Watauga Counties, is under prospecting claim, and many companies and individuals now are on the scene conducting

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North Carolina (*Continued*)

drilling operations to determine if uranium deposits warrant mining of the ore.

A report of the Atomic Energy Commission just released points to the possible commercial development of the area, which includes at least 125,000 acres. The report by geologist Marcellus Stowe calls the area "the hottest area of any extent in the eastern United States."

Now on the scene is the Putnam Mining Co. of Ohio, which has a prospecting claim to an estimated 30,000 acres, the New Jersey Zinc Co., which has perhaps another 10,000 acres, and the Murchison Investment Co. of Dallas, Texas, which has leased the claims of a number of individuals.

Hottest areas appear to be along Lost Cove Creek where the Putnam company already has drilled hundreds of feet through uranium-holding granite and gneiss, and along North Harper's Creek, also in Avery, where other drilling operations are being conducted by the E. J. Longyear Co. of Minneapolis, Minn. Putnam has been on the scene since December 1955, and individuals represented by the Murchison company, were the next to get prospecting permits. New Jersey Zinc, with a seven-man crew, as of March 3 still was waiting to get clearance on its claims after 14 months of surface testing.

Hardinge

THICKENERS and HYDRO-SEPARATORS

. . . for all clarifying, thickening and de-sliming operations.

For flotation concentrates thickening ahead of filtering—or for tailings disposal or reclamation, Hardinge Thickeners provide:

1. "Auto-Raise" to avoid lost production from overloads.
2. Manual or power raise to supplement "Auto-Raise."
3. Replaceable ring-type ball bearing support for rotating mechanism.
4. Spiral rakes for maximum underflow density.

Also available are froth rakes for froth-free overflow and superposed type tank construction for minimum floor space and building economy. Complete specifications on request. Bulletin 31-E-1

HARDINGE COMPANY, INCORPORATED

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OREGON

Bureau of Mines has begun restoring to operating condition the Government's zirconium production plant at Albany, at AEC request, Secretary of the Interior Douglas McKay announced.

Restoration of the plant, which consists of four buildings at the Bureau's Northwest Electrodevelopment Laboratory, is to be completed by early June, Secretary McKay said.

Annual capacity of the Albany plant is about 300,000 lb zirconium sponge metal and several thousand pounds of hafnium metal. Hafnium, which is contained in zirconium ores, likewise has important uses in the atomic energy field.

After private industry entered the zirconium field and began producing the metal in quantity, the Bureau shut down the Albany plant last spring at the direction of the Atomic Energy Commission. At that time the AEC requested specifically that the Bureau maintain the plant equipment so that production could be resumed on three months' notice.

Stephen M. Shelton, director of the U. S. Bureau of Mines' Region I and chief of the Bureau's Northwest Electrodevelopment laboratory at Albany, has resigned from Government service to become general manager of a plant, Oregon Metallurgical Co., a newly-formed Oregon corporation, will build to produce titanium and zirconium ingots.

Shelton reported the proposed plant will specialize in titanium but also process zirconium sponge.

Shelton's resignation, effective March 15 ends 27 years of Federal service. He began with U. S. Bureau of Standards in 1931, shifted to Bureau of Mines in 1935. After World War II, he became head of the foreign minerals division, Bureau of Mines, in South America and Mexico. He was appointed director of the Bureau's Division No. 2 in 1946 and became head of Division 1 when Alaska, Washington, Montana, Idaho and Oregon were consolidated two years ago.

UTAH

Hecla Mining Co. president L. J. Randall has disclosed the commercial grade hole drilled on its Hot Rock uranium claims revealed ore in the same layer as the nearby Radon mine. Latter is now shipping 2,500 tons monthly.

Randall said it is too soon to say whether ore exists in commercial quantity —the find may be on the fringe of Radon.

Both the Hot Rock and Radon properties are joint projects of Hecla and Federal Uranium Corp.

Diamond drilling on the Hot Rock property is being done under an $81,000 program partially underwritten by the DMEA.

The hot hole cut 7.9 ft of ore that assayed 0.481% radioactive ore—about the same grade as the ore now being shiped from Radon.

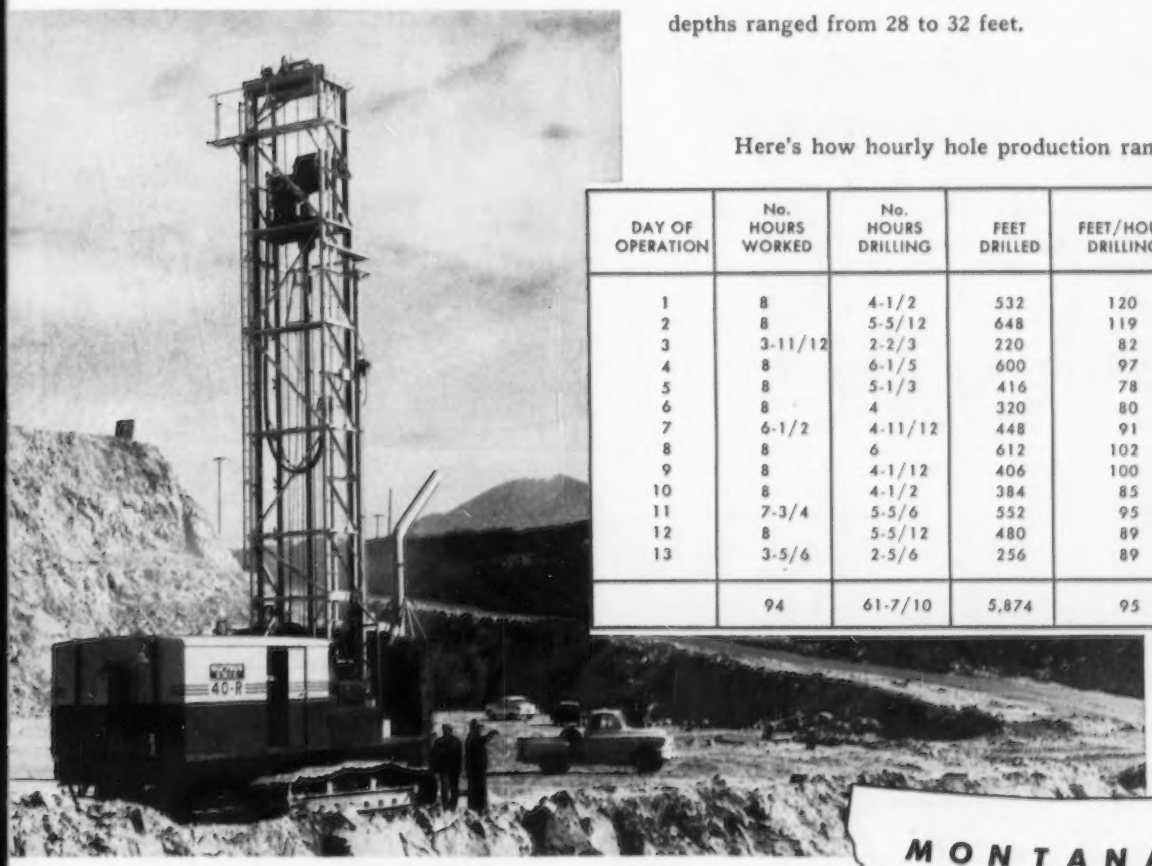
Moab Drilling Co., headed by Charles A. Steen, has signed an exploration pact

Butte, Montana . . .

another example of how Bucyrus-Erie rotaries cut costs on big-volume stripping jobs

F & S Contracting Company and Morrison-Knudsen Company, Inc., joint venture stripping contractors on a large Montana copper property, have adopted a modern high-speed drilling program which allows maximum economy in use of shovel loading and truck hauling units. The drill chosen to meet their needs was this electrically powered Bucyrus-Erie 40-R rotary.

According to F & S officials, the 40-R has worked so rapidly that it has stayed ahead of a 6-yd. shovel, even when operating less than a full shift each day. Drilling procedure consists of putting down 9-in. diameter holes spaced on 21-ft. centers. A daily log for the initial period of operation shows the 40-R drilled 5,874 feet of hole through decomposed granitic rock in 62 hours drilling time — a rate of 95 feet per hour. Hole depths ranged from 28 to 32 feet.



Here's how hourly hole production ran:

DAY OF OPERATION	No. HOURS WORKED	No. HOURS DRILLING	FEET DRILLED	FEET/HOUR DRILLING	FEET/SHIFT HOUR
1	8	4-1/2	532	120	67
2	8	5-5/12	648	119	81
3	3-11/12	2-2/3	220	82	56
4	8	6-1/5	600	97	75
5	8	5-1/3	416	78	52
6	8	4	320	80	40
7	6-1/2	4-11/12	448	91	69
8	8	6	612	102	77
9	8	4-1/12	406	100	51
10	8	4-1/2	384	85	48
11	7-3/4	5-5/6	552	95	71
12	8	5-5/12	480	89	60
13	3-5/6	2-5/6	256	89	66
	94	61-7/10	5,874	95	62-1/2

When excavation quantities run high, the fast, large-diameter hole making ability of Bucyrus-Erie rotaries really pays off. Let us tell you how they can cut preparation time and drilling costs in your operations. Write today for detailed, illustrated literature. Model 40-R drills 6-3/4 to 9-in. holes and is available with either diesel-electric or full electric power. Model 50-R drills 9-7/8 to 12-1/4-in. holes and is electrically powered.

BUCYRUS ERIE

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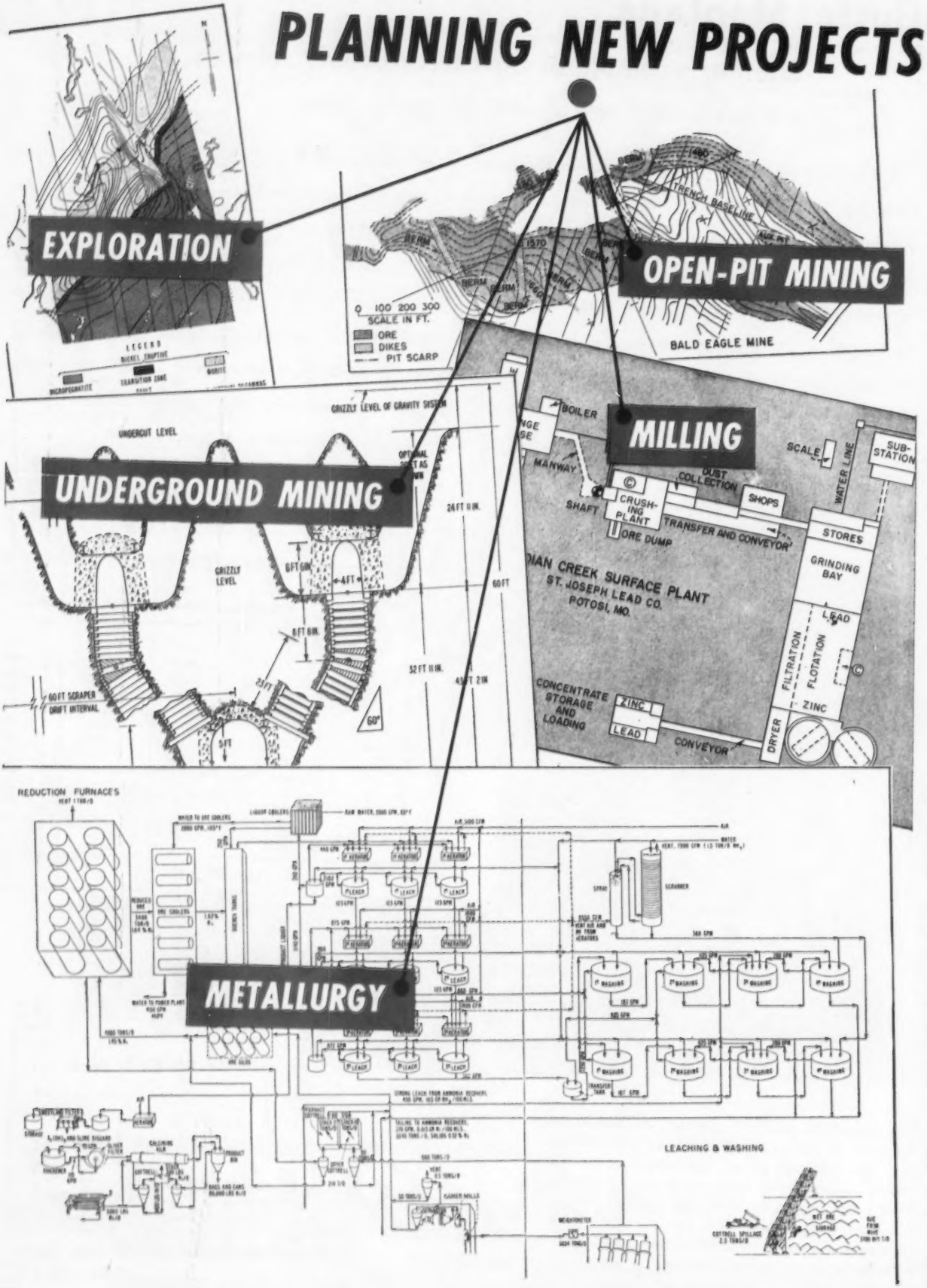
PLANNING NEW PROJECTS



. . . EXPANSION . . . IMPROVEMENTS?

You'll Have Practical, Everyday Use for

E&MJ's 1956 Mining Guidebook and Buying Directory Issue

A 13th issue devoted to "Planning Mine, Mill and Metallurgical Development" . . . Coming in Mid-June as a part of your regular E&MJ subscription.

New techniques and processes, accelerated exploration, growing market demands, greater emphasis on minor metals, decreasing ore grades, higher operating costs – these factors are making rapid changes in the industry. And as every mining man knows, the growing complexity of mine and plant operation makes it difficult to keep up-to-date, points up the need for thorough, effective advance planning.

Mine and plant planning for profit – to help you take full advantage of the vast expansion in metals and non-metallics ahead – will be the key theme of E&MJ's 1956 Mining Guidebook. Here in one issue you'll find field-tested, practical approaches for analyzing your objectives and planning new projects, revisions or improvements in existing operations – a "Planning Guidebook" on exploration, open-pit and underground mining, milling, metallurgy, and auxiliary operations.

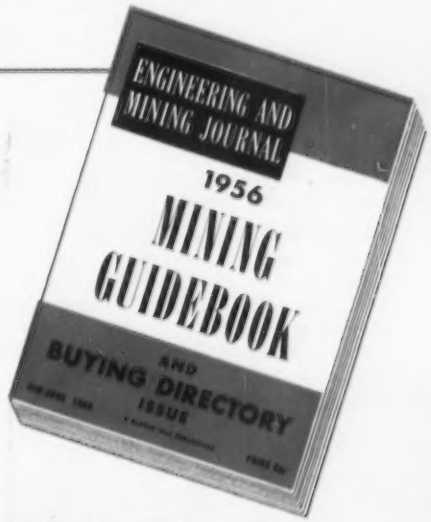
What you need to do the best job . . . what types of equipment are available . . . where they are most effective . . . their limitations . . . special applications. That's the sort of useful information E&MJ's 1956 Guidebook will offer . . . on all major phases of operation . . . in one complete volume.

Plus, of course, a new and enlarged Buying Directory of Manufacturers offering equipment, services and materials to the mining industry.

You told us what you needed. The editors set the 1956 theme only after a thorough study of industry activity and subscribers' problems, coupled with hundreds of comments and suggestions. The 1956 E&MJ Guidebook is a regular subscriber service, you will receive at no additional cost.

What to Look for in E&MJ's 1956 Mining Guidebook

1. *A "Planning Guide" to important phases of exploration, open-pit and underground mining, milling, metallurgy and auxiliary operations.*
2. *A comprehensive presentation of the techniques proved effective . . . accompanied by a practical analysis of the types of equipment available . . . where they are most effective . . . limiting factors . . . special advantages.*
3. *A new and enlarged Buying Directory of Manufacturers offering equipment, services and materials to the mining industry.*
4. *Specific product advertising prepared by manufacturers to help users select actual equipment.*



USEFUL . . . PRACTICAL . . . . . NO MATTER WHAT YOUR JOB

Little downtime with great capacity is the record set by this 4500 dragline mining limonite ore for U. S. Pipe and Foundry Company near Russellville, Ala.

There's no place for undersized, underpowered mining machines when you're aiming for more production per man hour. That's why the husky Manitowoc 4500 is today's "greater output" champ among mining operators.

United States Pipe and Foundry Company of Birmingham, Ala., use two 4500 draglines equipped with 140′ booms and 4 yd. buckets for mining limonite ore. Satisfactory performance from three Manitowoc 2-yd. shovels led to their choice of the larger 4500 machines. Top capacity with little downtime for all five units, is due to Manitowoc's simple design and superior construction.

TOP DESIGN FEATURES MAKE A TRUE MINING MACHINE

GREATER SIMPLICITY OF DESIGN directs more power to the dipper or bucket. Only four main shafts — only 15 gears — only working gears turn.

GAS OR DIESEL UNIT DRIVE effectively utilizes power — eliminates thousands of electrical wires and components. Full power can be applied to any operating function with less dead weight than is found in electric machines. Greater mobility — no restrictive electrical cables.

EXCEPTIONAL STABILITY assures top capacity. Massive carbody, adequate counterweight and long, wide crawlers let you reach way out with full safety and low ground bearing pressures.

SPECIAL HI-LIFT SHOVEL BOOMS available in two lengths — 60′ boom with 45′ tubular stick and 50′ boom with 37′ stick.

POWER-SMOOTH TORQUE CONVERTER, pioneered in power shovel application by Manitowoc, multiplies engine torque three times. Efficiency is increased and engine life extended. With engine power balanced to the load, engine **cannot stall — cannot be overloaded.** Make the Manitowoc 4500 your next mining machine. Send today for your **free** copy of the new 20 page Model 4500 illustrated catalog — no obligation!

Air-operated controls and clear, unobstructed view from large comfortable cab help 4500 operator do a better job.

MANITOWOC
SHOVELS 1-5½ YD. Speedcrane CRANES 20-100 TON

MANITOWOC ENGINEERING CORP.
Manitowoc, Wis.

Utah *(Continued)*

with Great Yellowstone Uranium Co., covering drilling of core holes on the latter firm's 23 claims in Utah's Big Indian District.

Mr. Steen's company will complete a minimum of 6,000 ft of core hole drilling on the claims about one-half mile from the Standard Uranium Co. property.

Phillips Petroleum Co.'s exploitation division has completed a pact with Amuranium Co., Washington, D. C., covering exploration on latter firm's 1,500 acres of claims in north end of Big Indian District, San Juan County.

Phillips will drill an initial 10 core holes in search for uranium. If the firm elects to continue with sinking of an additional 20,000 ft of hole, Phillips will win a 50% interest in the properties.

In advent of commercial discovery, Phillips would be mine operator.

Vitro Corporation of America has acquired all the assets and holdings of Uranium Prospectors Ltd., a Patino-family connected-firm with headquarters in Grand Junction.

Uranium Prospectors, or "UP Co. Ltd.," as it is known on the Plateau, has extensive claim holdings and leases about 17 miles north and west of Green River.

The firm has developed a mine there and it is hope of J. Carlton Ward, New York, Vitro president, that shipments of carnotite-type ore from this mine will hit 1,500 tons monthly. Ore will go to Vitro's Salt Lake mill, 70% expansion of which is now under negotiation with the Atomic Energy Commission.

Vitro paid $50,000 in cash and promises to pay other funds from ore receipts to UP Co. Ltd.

New officers of UP Co. will be: William B. Hall, president; R. C. Cole, vice president, and Harold D. Haight, secretary-treasurer. All are officers of Vitro Uranium Corp., at Salt Lake City, a division of Vitro Corporation of America.

Paramount Mining and Development Corp. in February shipped the first carload of copper ore from its property north of Moab. The ore, high in silica, went to the AS&R smelter at Garfield.

Clifton H. Troxell, Paramount president, said the company's ore reserve, outlined by drilling and trenching, was estimated at 750,000 tons, all close to the surface. John Hunt, field superintendent, said the company would be mining at the rate of 300 tpd by mid-May.

Utex Exploration Co., in February exercised its option to purchase the interest of W. T. Hudson, early associate of Charles A. Steen and former vice president of Utex. Hudson was paid more than $500,000 in an "amicable" transaction, a company announcement said.

Judella Uranium Corp., Regina, Sask., has paid $11,000 for purchase of 101 uranium claims in San Juan County. The Canadian firm ultimately would have to put up $10-million to acquire the properties from Harvey S. Mecham, Salt Lake City, Clair Larsen, Roosevelt, Utah, and others.

The Sad Sack, Happy Canyon and

FOR LOW COST HANDLING AND CRUSHING of ★ROCK ★ORE ★SLAG ★MINE REFUSE ★LIMESTONE ★GYPSUM and other materials

McLANAHAN Heavy Duty RECIPROCATING PLATE FEEDER

Built to handle materials from the size of sand to shovel-loaded rock. Rate of material flow automatically controlled. Quickly adapted to production capacity of any machine.

A combination of McLanahan Reciprocating Plate Feeder and Rockmaster Crusher is your answer to the most economical feeding and crushing of large tonnages of rock, ore, limestone, and other materials. Furnished as separate units or in combination as required.

McLANAHAN Single Roll ROCKMASTER CRUSHER

Here is the economical solution to the most rugged crushing applications involving primary or (secondary) reduction of shovel-loaded rock and ore. Special features include —high capacity, low headroom and many other distinct advantages.

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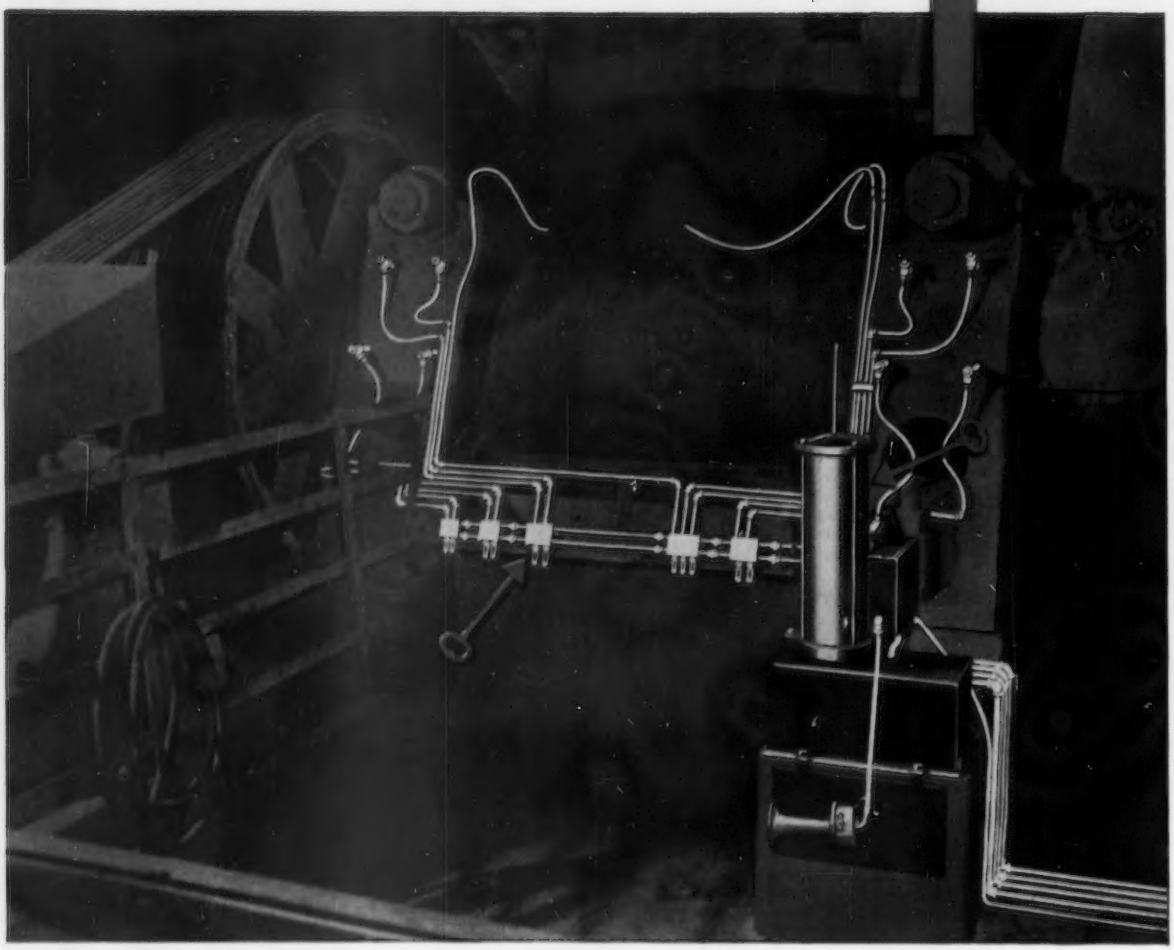
PIT, MINE AND QUARRY EQUIPMENT HEADQUARTERS SINCE 1835

255 Wall Street, Hollidaysburg, Pennsylvania

Crusher bearings lasted 13 months, but with Farval no new ones in 6½ years

FARVAL—
Studies in Centralized Lubrication
No. 188



Back in 1949, an automatic system of Farval Centralized Lubrication was installed on this Fairmount Crusher. It paid for itself in 4 months by the savings in lubricant and labor that resulted.

In the nearly 7 years of its operation, Farval has returned rich dividends. Before the system was installed the life of a set of bearings was only 13 months. Today the identical bearings installed when the lubrication system was applied are still in service. Maintenance cost has been negligible. This success record led the cement company to specify Farval for a new mill crane and a power shovel.

Investigate Farval for your equipment. Write for Bulletin 26-R. The Farval Corporation, 3281 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.

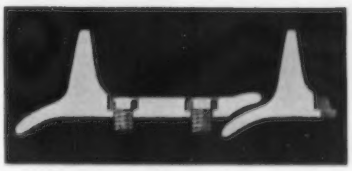
KEYS TO ADEQUATE LUBRICATION—
Wherever you see the sign of Farval—the familiar central pumping station, dual lubricant lines and valve manifolds—you know a machine is being properly lubricated.
On this crusher in an eastern cement plant, savings in lubricant and labor, due to Farval, run well over $375 a month.

Switch to extra-tough AMSCO® MANGANESE STEEL TRACTOR SHOES

When the going is extra tough, as in rocky areas or abrasive mineral soils . . . tractor shoe replacement can become a major cost item. Both repair time and down time eat up profits.

Switch to "the toughest steel known" . . . Amsco Manganese Steel . . . for tracks and grouser bars. Check their much longer service life against the moderate extra cost. Add to this the greater efficiency and pulling power of your tractor, over a longer period of time. The answer: *important operating economies.*

Amsco Manganese Steel gives excellent resistance to abrasion accompanied by impact . . . actually *work-hardens* in use. Write for full information on long-wearing Amsco Manganese Steel Tractor Shoes—the economical answer to high track-replacement costs.



COUNTER-SUNK BOLT HOLES

Amsco Track Shoes have holes countersunk for less wear on bolts. Saves cost of replacing bolts when changing shoes.

AMERICAN Brake Shoe COMPANY

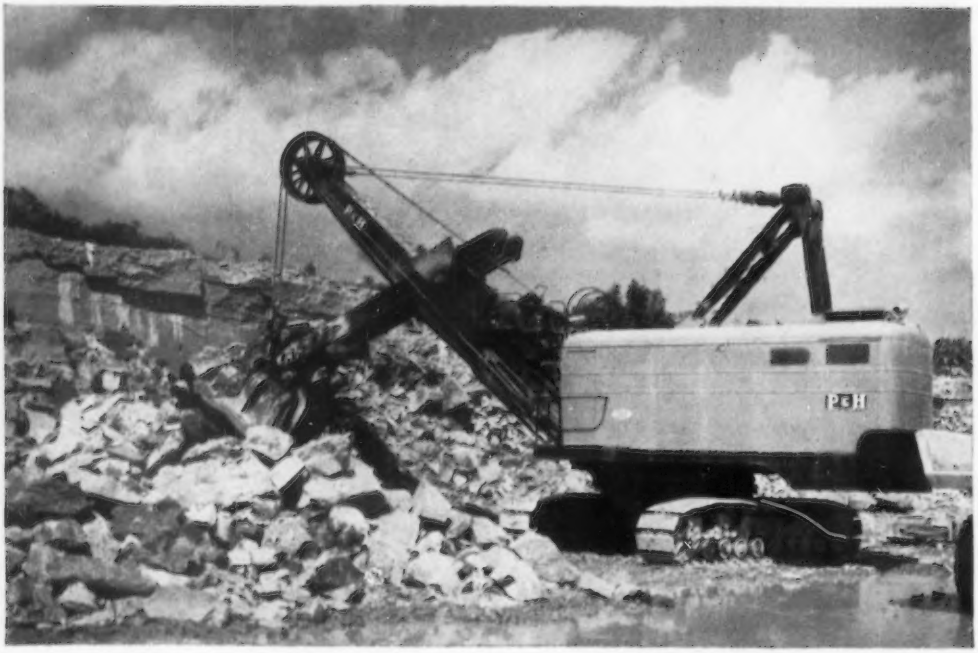
AMSCO

American Manganese Steel Division • Chicago Heights, Ill.

OTHER PLANTS IN: DENVER, LOS ANGELES, NEW CASTLE, DELAWARE, OAKLAND, ST. LOUIS, JOLIETTE, QUEBEC

Which electric leads the

Magnetorque* and Electronic Controls



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put P&H WAY AHEAD!

How can P&H performance be so far ahead of all other electric shovels?

One reason is Magnetorque, the electro-magnetic transmission that gives smooth, stepless operation. Just look what you get. Simplest hoist control, by far. Simplest hoist machinery, by far. Instant response to control and load changes. Automatic cushioning of shock loads. Greater bail pull *in the bank!* Greater efficiency. Cuts maintenance and operating costs. Plus many other advantages. Exclusive with P&H.

Another reason. P&H Electronic Controls. They give you instant response to signal. Stepless control. 12% faster cycle. 16% savings in operating time. Less operator fatigue. Reliability. Simplicity, plus many other advantages, exclusive with P&H.

For complete information about these *exclusive P&H features,* and others, call your P&H representative. Harnischfeger Corporation, Milwaukee 46, Wisconsin.

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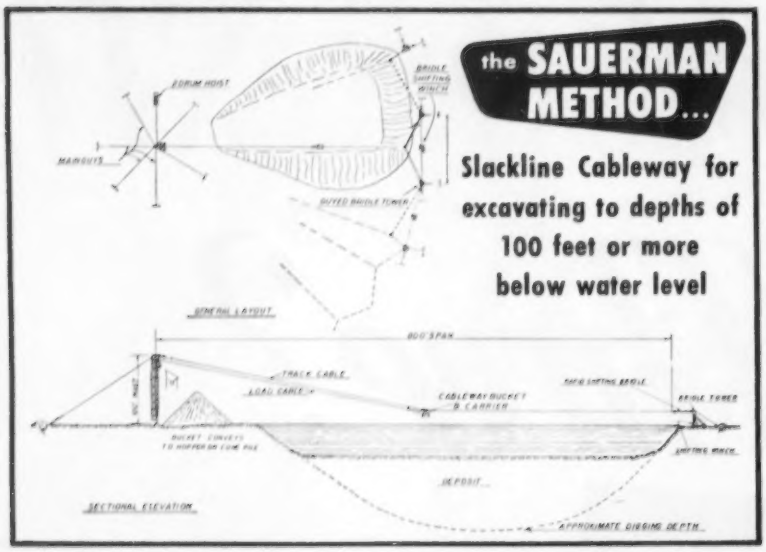
P&H ELECTRIC SHOVEL DIVISION

HOW TO GO UNDER WATER AND GET ALL THE MATERIAL FROM YOUR DEPOSIT


the SAUERMAN METHOD...
Slackline Cableway for excavating to depths of 100 feet or more below water level
GENERAL LAYOUT
SECTIONAL ELEVATION
APPROXIMATE DIGGING DEPTH

Above drawing was prepared for a specific slackline installation and does not represent maximum spans. Rapid shifting bridle is not needed for many deposits.

Cableway at Cabinet Gorge Dam digs and hauls from tailrace 1000 ft. away. **(Full details in Sauerman News No. 143.)**

New York gravel producer switched to cableway for underwater operation of his pit. Average haul is 600 ft. from a 50-ft. depth **(Sauerman News No. 141).**

Deposits below water yield new profits with a long reaching Sauerman Slackline Cableway. On job after job this machine has proved to be the most efficient for this type of operation. It is especially effective where the material to be excavated has good depth and will flow to the bottom of the cut. For shallow deposits or non-caving material a rapid shifting device is used to change the line of operation.

One man controlling the hoist digs, conveys and elevates from deposit to plant over spans of 1000 ft. or more . . . across streams, lakes, bogs or deep pits. The powerful load line pull insures digging penetration. Tensioning the track cable lifts the bucket which is inhauled at high speed and dumps automatically. Gravity return completes the fast operating cycle. Bucket capacities range from ⅓ to 3½ cu. yds.

To get fast, economical long range excavation, and the shortest, most direct way from pit to pile use a slackline cableway. Contact Sauerman for specific recommendations. No obligation. Request Catalog C, showing detailed specifications and photos of slackline cableways in action on all types of deep digging jobs.

SAUERMAN BROS. INC.

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Crescent Scrapers • Slackline and Tautline Cableways • Durolite Blocks

Utah *(Continued)*

Castle Rock claims are in the Dirty Devil River area.

United Park City Mines Co. has encountered a high grade lead-silver-zinc orebody in the Crescent fissure of its Park City District mine, according to F. A. Wardlaw Jr., vice president of the company.

Mr. Wardlaw said that miners had pursued the ore some 60 ft along the strike of the fissure, but that recent rounds fired had disclosed a weakening of mineralization.

Discovery is important primarily in terms of encouragement as the Crescent is regarded as an excellent prospect ground.

Mr. Wardlaw said the discovery was on Crescent in the old Daly-West ground on the 2100-ft level—a depth which corresponds to the 1500 level in the Ontarios section of the mine from which principal shipments are now being made.

Radiore Uranium Corp. reported drilling on its Indian Creek property has found good ore showings, but was awaiting complete reports from the field before assessing value of the find. Pioneer Drilling Co. of Moab contracted with Radiore in February to drill and mine Radiore holdings totaling about 440 acres.

Contract for delivery of 300 tons of ore to the AEC mill in Monticello before June 19 was obtained in February by Moab Uranium Co-Sovereign Uranium Gas & Oil Co. The two companies are developing a new property in Mineral Canyon, to be known as the Matchless mine, from which chemical assays exceeding 3% uranium oxide have been reported.

WASHINGTON

Tungsten Uranium Mines and Rayrock Uranium Co. have signed an agreement under which Rayrock will explore Tungsten's 200-acre Thompson lease in the Mount Spokane district for a half-interest in uranium discoveries. When weather permits, source of a radio active spring will be sought.

Rayrock, incorporated in mid-1955, now holds 700 acres under lease in the Mount Spokane area. Carl Larson, Spokane, is president. Other officers are Dan McDougald, vice president, and Wayne Franks, secretary-treasurer, both of Spokane.

Stockholders of Tungsten Uranium have elected C. A. Voight, Spokane, president, and Wellman Clark, Spokane, secretary-treasurer. The firm owns the Germania tungsten mine north of the Spokane Indian reservation and holds uranium leases in the area.

Dawn Uranium and Oil Co. has begun open-pit mining in the Mount Spokane district under a 50-50 profit-sharing agreement with Target Uranium Co. C. Ross Echlin, Dawn secretary-treasurer, said his firm drilled 10 holes on Target's prop-

THE NEW AIR POWERED CRYDERMAN SHAFT-MUCKER

• *Newly Patented Canadian Development*

A CRYDERMAN "FIRST" REVOLUTION IN SHAFT SINKING

The Story of Cryderman's new method of Shaft Mucking is indeed interesting. We of the Cryderman organization are proud of the remarkable record of this revolutionary machine. The many operators now using the Cryderman machine claim it is the greatest advance in shaft mucking in years.

This is not a mere claim, but the results of comparative studies of the Cryderman with other mucking methods. The machine is revolutionary not only because of its use today in round, square and rectangular shafts but also because of its application in slopes or incline shafts. The Cryderman is easily adapted for slopes or inclines while still retaining the basic principle of the gimbal bracket and telescopic boom.

With seven air cylinders centrally controlled by two levers, the operator actuates directional valves that control the entire mucking operation. Air cylinders control the swing and lift of the telescopic boom as it extends with any desired pressure to push into the muck pile for a full clam load, retract and discharge into the muck skip. This positive controlled, easy operation quickly mucks out the shaft round. The machine is lowered to the mucking position without delay and quickly hoisted clear of the blast.

Saving time and money in your shaft job is the big item. Cryderman does this for you because it eliminates fatigue and gets the job done so much faster and cheaper. No matter what the size, slope or incline, why not write us today and learn how this revolutionary Cryderman mucking machine can be adapted to your shaft job.

SHAFT & DEVELOPMENT MACHINES CO.

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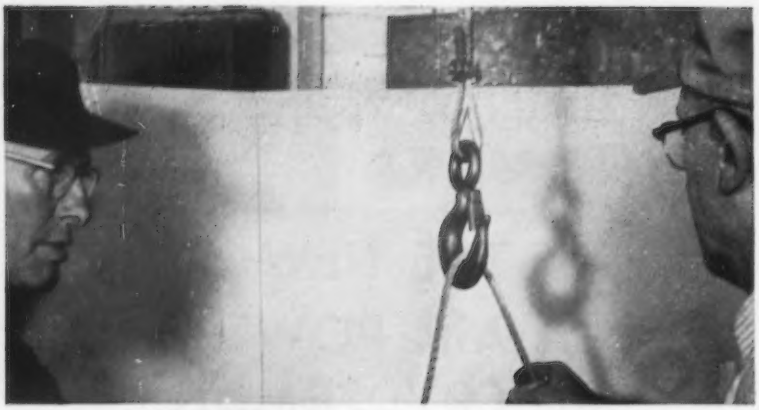


SAFETY HANGS BY A HOOK

It's small and relatively inexpensive, but a hoist hook carries the full load —as much as a crane is designed to handle! All hooks may look similar, but Laughlin hooks offer a combination of features that make them outstandingly safe. First, they are forged from special bar quality steel, then accurately heat treated; finally, Laughlin's precision die design controls the metal's grain flow during forming to keep the elastic limits of the hooks at their proper ratings.

Next time you need hooks remember that *safety hangs by a hook*—and Laughlin hooks are the safest!

THE RIGHT COMBINATION

An exacting combination of design, steel and drop forging goes into Laughlin Shackles. A combination that results in maximum strength without brittleness that can result in fracture under shock load or in extreme cold! Pins used in Laughlin Shackles are forged from the same high quality steel —their extra hefty design makes them safer when shock loads accidently occur. When you see the famous Laughlin trade mark on shackles (and all other Laughlin fittings), you're seeing the mark of safety! Your nearby Laughlin Distributor has shackles in sizes from 5/16" to 3".

LAUGHLIN LINKS INSTALLED QUICKLY

Lower downtime—fast changeover is reported by companies using super safe Laughlin Double Clevis Links to couple standard and alloy chains to fittings. Users everywhere have cut out expensive, time-consuming welding and blacksmithing in favor of simple installation. Laughlin's heat treated Double Clevis Link attaches 1/4" to

1/2" chain to rings, end and sling links, eye hooks, pad eyes, tractor eye bolts and other fittings.

The world's most complete line of fittings for chain and wire rope is described in the catalog available from your Laughlin Distributor, or Thomas Laughlin Division, American Hoist & Derrick Co., Portland, Maine.

SAFETY IN SIGHT

Ever worried about your crew forgetting the rated capacity of a block? You're free from worry and they're free from danger with Crosby "Load-Rated" Blocks because the load capacity is *embossed* in the side plates! A quick glance shows what the limits are —no chance to overload the block by mistake. Crews the world over are protected by Crosby "Load-Rated" Blocks —are yours? Crosby Products Division, American Hoist & Derrick Co., St. Paul 1, Minnesota.

Washington *(Continued)*

erty and found commercial ore in six.

Virgil Chamberlain, Dawn geologist, said 6,650 tons of ore are indicated from near the surface to a depth of 60 ft. Company expects a shipping permit from the AEC.

Twenty holes drilled on Dawn's adjacent lease disclosed commercial ore in four. The two leases of 80 acres each, one to Dawn and the other to Target, will be combined as a joint operating venture, giving each firm a half interest in the other's findings.

WYOMING

Another uranium discovery in the Pryor Mountains along the Wyoming-Montana state line has been reported, this one by Teton Exploration Co. of Riverton.

Firm has staked 30 claims on the East Pryor Mountain and is currently engaged in drilling operations. A sample of the ore was said to have assayed 3% uranium oxide.

Completion of an access road will be necessary before the claims can be developed extensively.

Prospectors from Greybull and Burlington, Wyo., claim to have discovered the first commercial deposit of uranium in Wyoming's Big Horn Mountains.

The group is organized into the Super Cub Mining Co. They have staked about 100 claims in an area 14 miles north of Kane.

The ore found there, tyuyamunite, is similar to ore being mined commercially in the Pryor Mountains along the Wyoming-Montana border.

Discovery has stimulated interest in prospecting on the Crow Indian Reservation in Southern Montana. Frank Boyd, realty assistant at Crow Agency, Mont., said interest is centered on the Devil's Canyon area just north of the state line.

The AEC ore-buying station at Riverton reported February shipments reached 80% of the record January output. Vitro Minerals Corp. was largest shipper with 3,500 tons.

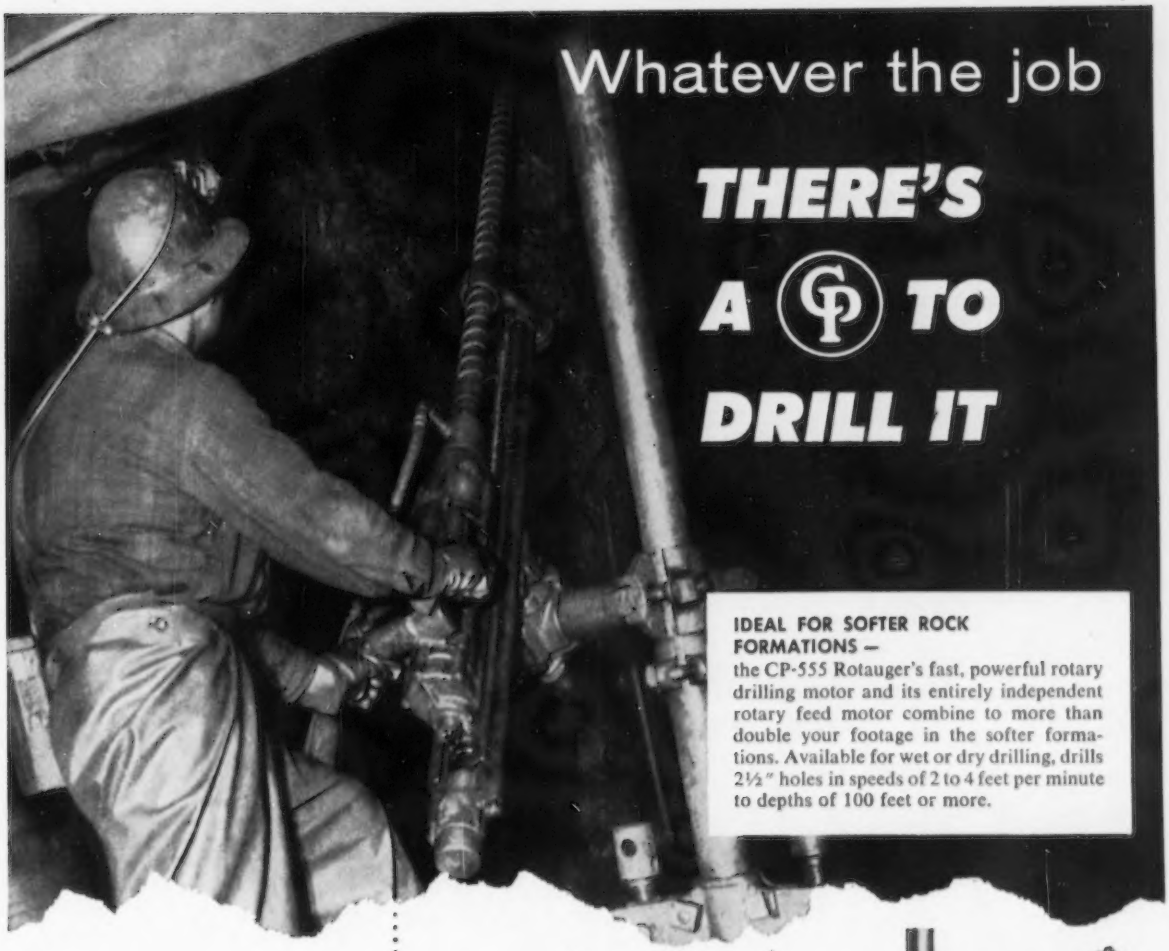
Most of the February ore came from the Gas Hills area of eastern Fremont County. Shipments came from Globe Mining Co., Vitro, Savannah Const. Co., and Lucky Mc Uranium Corp.

IN CANADA

ALBERTA

An iron prospecting permit covering approximately 34,000 acres in the foothills west of Lethbridge has been issued to West Canadian Collieries, Ltd., according to officials of the Department of Mines and Minerals.

This is the second permit issued for that area and points up the interest which reportedly has existed for some time as to



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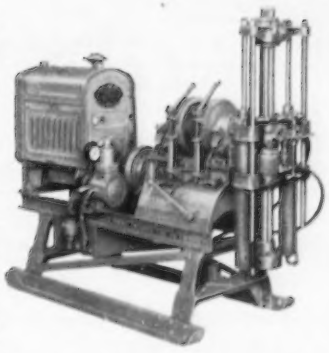
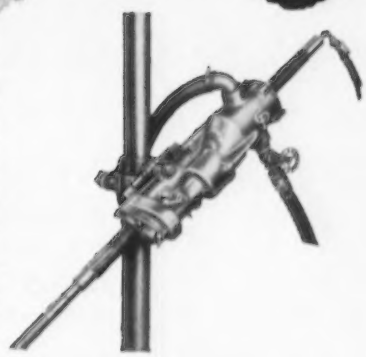


FOR EXPLORATORY DRILLING—CP Diamond Core Drills are available in air, electric, gasoline and Diesel Drives. Capacities to 2250 feet with E-EX Fittings. For skid, column, jeep or truck mounting.



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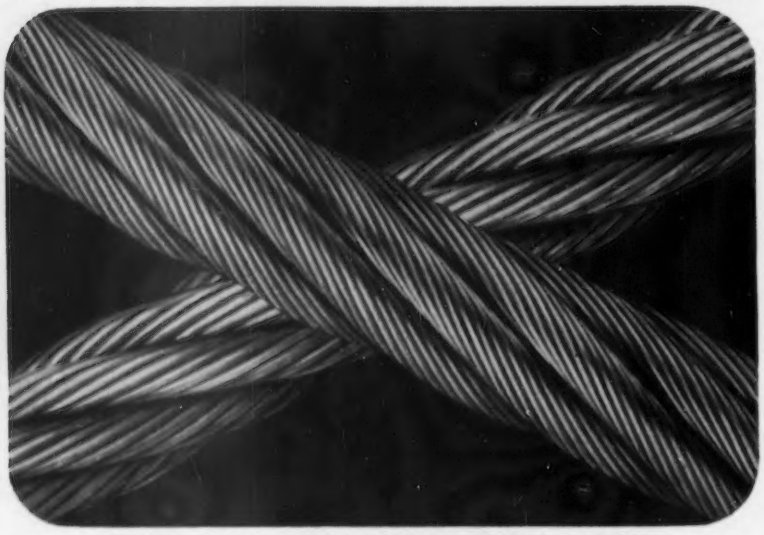

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One uranium ore processor was able to eliminate four of his five thickeners with the addition of Separan 2610. Two banks of filters and several earthen ponds were also no longer needed. The savings? Nearly $3000 per day. In another uranium mill, production was at 50% of capacity due to low filtration rates. But when 0.2 pound of Separan 2610 per ton was added, the filtration rate doubled—and so did production!

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The advantages of using Separan 2610 are numerous. Overhead clarity is increased, materials lost in overflow decreased. In filtration, this synthetic non-ionic polymer increases cake weight per unit area of filter and reduces moisture content. Washability is increased, the cake is more homogenous and easier to handle.

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Separan 2610 is the latest addition to the Dow family of chemicals for mining. Dow Xanthates, the collectors to use in all flotation of sulfide minerals, and Dowfroth® 250, the frother for improved metallurgy with reduced frother consumption, are two other well-known Dow mining chemicals. For a sample or information on any of these products write to THE DOW CHEMICAL COMPANY, TECHNICAL SERVICE AND DEVELOPMENT, Midland, Mich., Dept. SC-926B-1.

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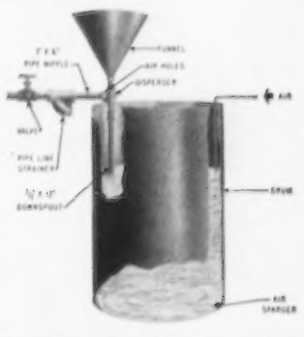

New Disperser has been developed by Dow to permit dissolving of large amounts of Separan 2610 without use of a mechanical mixer. The solution needs no preservative in normal storage or use.

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Actual photo during exhausting of explosion gases

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Alberta *(Continued)*

the possibility of developing iron deposits in the Crowsnest area in southwestern Alberta.

ONTARIO

Can-Met Exploration has received a letter of intent covering purchase of $69,825,000 worth of uranium precipitates over a 5-yr period by Eldorado Mining and Refining, the government's official uranium purchasing agent. Agreement is the fourth largest in Canada and the fourth to a Blind River area company. It provides for a milling rate of 2,500 tpd with production slated for April 1, 1957. Two shafts are currently being sunk.

An estimated 10-million tons grading 0.122% uranium oxide has reportedly been outlined by diamond drilling on the Blind River area property of Milliken Lake Uranium Mines. Nine diamond drills are being employed in extending tonnage and in detailing present indicated ore. There is an additional 2-million tons classified as possible ore.

Panel Consolidated Uranium Mines has reportedly indicated a total of 4.7-million tons grading 2.12 lb uranium oxide per ton on its Blind River area property. Premium price contract negotiations have been opened with Eldorado Mining and Refining. Six machines are currently drilling from the ice on Quirke Lake to complete filling in detail of the ore-bearing conglomerate bed.

Diamond drilling from the 600, 750 and 900-ft levels at the Vermillion mine of Consolidated Sudbury Basin Mines in the Sudbury area, has outlined 5.5-million tons. Average grade is calculated at 1.34% copper, 1.07% lead, 4.5% zinc, 0.024 oz gold per ton and 1.61 oz silver, after allowance of 10% for dilution. It is understood that total ore indicated on the large property now amounts to nearly 14-million tons. Work is continuing in three areas.

Expectations are that the current season's shipments from Steep Rock Iron Mines will reach 3,250,000 tons, valued at some $36-million. Company's expansion program is aimed at 5.5-million tons annually by 1959. Sales in 1955 amounted to just over 2.2-million tons, having a gross value of $23.8-million. The operation is only 140 miles from the Canadian Government's expanded ore docks at Port Arthur in the Lakehead district, Lake Superior.

Maybrun Mines is preparing to start drifting on two levels at its Atikwa Lake area copper-gold property, 50 miles southeast of Kenora. A 3-compartment shaft was opened to provide two levels at 150 and 275 ft. Four headings are being established and arrangements have been made for a minimum of 10,000 ft of underground diamond drilling. Surface drilling is also being continued.

Dravo of Canada Ltd., Toronto, has started shaft sinking operations on a

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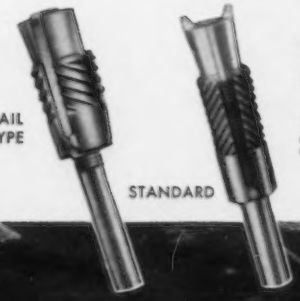

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Ontario (*Continued*)

new production-size shaft for Farady Uranium Mines Ltd. near Bancroft. The shaft, Faraday's No. 1, will have three compartments and will be sunk to a depth of 1,050 ft below the adit level. Contract also calls for 6 standard shaft stations, 2 pumping stations and a loading and spill pocket.

Standard Ore and Alloys Corp. of New York and Frobisher Ltd. announced that they are joint venturing with two other firms on 72 mining claims in the Sault Ste. Marie region.

Aerial survey has indicated the possibility of a multi-million ton iron orebody, and drill teams have been sent out to ascertain the size and grade.

QUEBEC

Quebec Chibougamau Goldfields is to sink a 3-compartment shaft to depth of 1,000 ft and install a permanent mining plant. Property is at Dore Lake in the Chibougamau area. Four drills have added materially to the ore picture. It is estimated that 1-million tons of good grade copper-gold material has been indicated to the 700-ft horizon as well as 3,000 tons per vertical ft of lower grade material.

The mill at Ascot Metals Corp. near Sherbrooke, is currently treating 460 tpd with the eventual objective of 500 tpd. Tonnage is being built up gradually from the reduced rate of 351 tpd during the final months of 1955. A drive is being pushed out from the new shaft at the Suffield mine and has encountered a deposit 10-ft thick, grading about 1.2% copper and 3% zinc at a point 60 ft from the shaft. Previous drilling had indicated an ore shoot of about 4 ft thick some 150 ft from the shaft.

Quebec Copper Corp. is accelerating development work on the new levels at its copper property in the Eastern Twps. Hoisting facilities have been expanded and a ball mill is being installed to increase milling capacity to over 1,000 tpd. Deepening of the shaft to 1,900 ft was completed recently and work will now be concentrated on opening new levels.

The 3-compartment shaft, now in progress at the Lake Chibougamau property of New Royran Copper Mines, is expected to reach its initial objective of 600 ft by May. Three levels are to be opened. In the meantime six diamond drills are in use to explore, both at depth and in length, for extensions of the two indicated copper zones.

Noranda Mines is planning to increase smelter capacity which will permit a 50% boost in copper output yearly. The expansion program, which will take at least 1½ years to complete, will mean installation of a third reverberatory furnace, as well as enlargements to other facilities. It will give the company a production capacity of 350-million lb copper a year, compared with present output of about 240-million lb.

Wire Rope at Work—This is a spot in the southeast coal fields, one where mighty mean digging conditions exist. Stripping is slowed by some frustrating sandrock formations. On this particular job, the big dragline excavator, with a capacity of 16 yd, was using only a 10½-yd bucket. That's how tough the digging had become.

A thick layer of overburden covered the coal. Rock or no rock, the overburden had to go. And go it did—with stout Bethlehem rope pulling and hoisting the bucket. This rugged wire rope was of course Purple Strand, Bethlehem's top grade. There was Purple Strand, too, on the shovel in the foreground. The ropes had been chosen with particular care, and even in the roughest kind of going, they easily weathered every stress.

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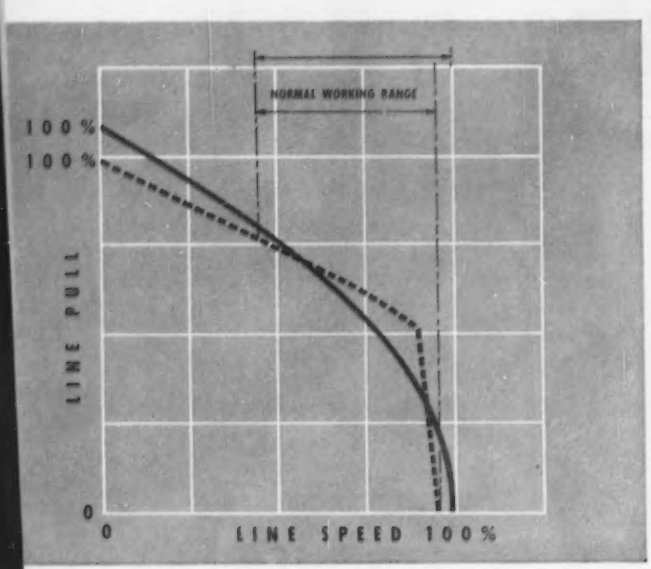
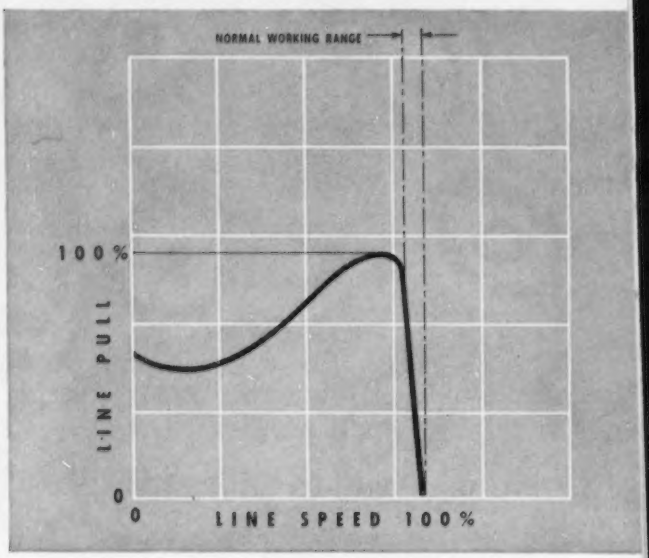


Power Performance of LIMA'S New Optional Unit:

A.C. Electric motor with torque converter drive. (Diesel-torque converter curve (dotted line) shown for comparison.)

With this drive, even under extreme loading, the motor will pull down in speed only a very small amount. It can never be stalled. The line pull will constantly increase through a long pull down speed range, depending upon the load applied.



Power Performance of A.C. Electric Motor with Direct Drive:

The motor speed and torque vary as shown for line speed and pull

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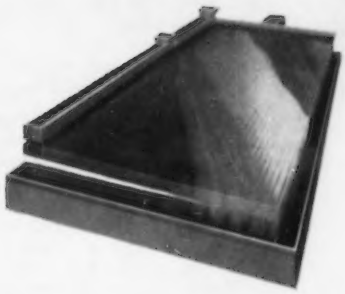
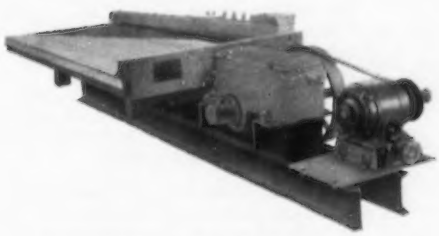
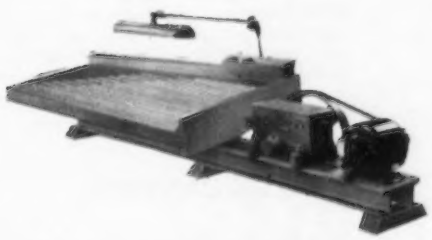


No. 6 Wilfley Table with variable speed V-Belt motor drive.

No. 11-D Wilfley Table showing concrete foundations.



No. 12 Wilfley Table with variable speed V-Belt motor drive.



No. 13 Spec. Wilfley Table with overhead Lamp, as Flotation Pilot Table.

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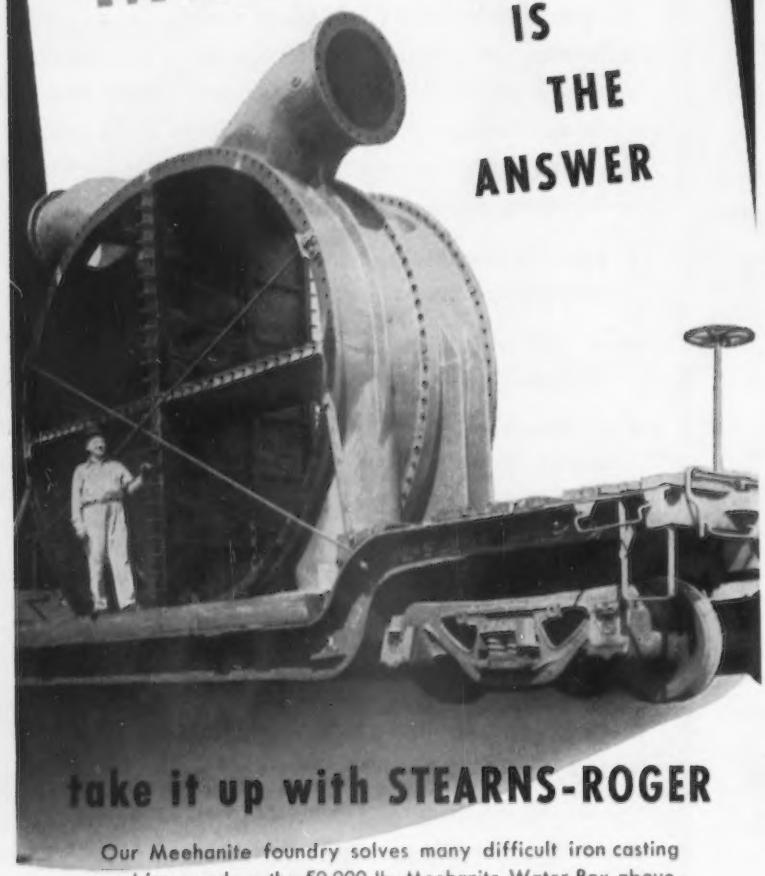

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MANITOBA

Combined Developments reports exploration work carried out on its Herb Lake lithium prospect indicates a zone 1,000 ft long. Drilling has been carried to the 300-ft horizon with assays ranging from 1.17 to 1.26% lithium oxide. True width of all mineralized sections has not been less than 30 ft. A bulk sample has been sent out for mill tests, and negotiations for sale of production are under way.

Copper-Man Mines reports diamond drilling is being carried out on its Herb Lake property where previous work indicated 115,000 tons grading 3.1% copper and 5.1% zinc. In the current drilling program, contracted for 10,000 ft, one heavy drill is probing the depth possibilities of the ore zone and a light drill is investigating the continuation of structure along the strike.

Nic-Cop Mines reports that two sulphide zones have been disclosed by surface work on its property near Rush Lake in the Bird River area. A magnetometer survey is planned. Company has holdings at Copper Lake, Bird River and at Manigotogan.

Montgary Explorations has indicated an additional 1-million tons of ore on its lithium holdings at Bernic Lake. Earlier drilling had outlined 2-million tons averaging 1.5% lithium oxide. A second shaft is planned while the old 175 ft shaft is to be deepened to intersect the proven ore deposits. Present plans call for a 500-ton concentrator. Company reports ample funds available to carry out planned diamond drilling, underground work and raising of the production shaft.

Aumaque Gold Mines reports a high grade gold vein has been intersected in the drilling of its Lynn Lake copper nickel prospect. Three zones of a well mineralized section indicate base metal possibilities. A 5-ft quartz-calcite zone showed visible gold with 20% sulphide, including copper, zinc, lead and silver. The property adjoins Sherritt Gordon Mines on the north and east.

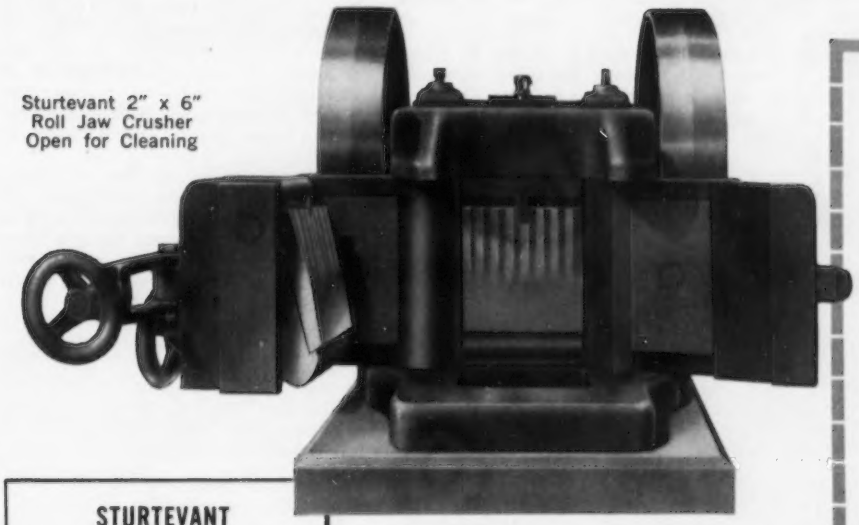
San Antonio Gold Mines Ltd. reports that a new program of development work will be undertaken at its Rice Lake mine with exploratory drilling being carried on from the 7 level to the 26 level.

Nicoba Mines has commenced diamond drilling on its Lynn Lake holdings located west and south of Sherritt Gordon. Low copper-nickel values were obtained in previous work and present drilling will investigate anomalies outlined in last year's geophysical survey.

NEW BRUNSWICK

With shaft sinking completed, plans are being made by Anacon Lead Mines for start of lateral work at its New Larder property, south of Bathurst. Station has been cut for the 1450-ft level, the mine's deepest for the time being. Crosscutting will be commenced on three levels ini-

"OPEN-DOOR" DESIGN CUTS SAMPLING TIME



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☐ SUPERFINE SELECTING ☐ GRANULATING ☐ CONVEYING

My dry-process materials are: _____

Desired capacity is: _____

Name _____ Title _____

Firm _____

Street _____

City _____ Zone _____ State _____

New Brunswick *(Continued)*

tially. Shaft, a 3-compartment opening, is 1500 ft deep, with levels to be spaced at 150-ft intervals.

NEWFOUNDLAND

Frobisher Ltd. and British Newfoundland Corp. are planning work during the spring season on uranium showings made on their adjoining concessions in Labrador. Several radioactive occurrences have been located and are considered important enough to warrant close investigation, which will most likely include diamond drilling. Brinco concession comprises 2,000-3,000 sq mi in a block along the coast northeast of Goose Bay, while the Frobisher block of about 300 sq mi adjoins to the south and west.

Maritime Mining Corp. is stepping up diamond drilling on its copper property at Tilt Cove. Accelerated program is expected to produce sufficient information to permit management to give a detailed picture of potentialities. Recent results are reported as encouraging.

Following interesting results in initial exploratory efforts last year, Advocate Mines is planning an intensive campaign for the coming field season on a 1,000-sq mi concession. Latter covers the Burlington Peninsula, which lies between Baie Verte and Notre Dame Bay on the north coast. Several base metals discoveries and an asbestos find have been made within the concession.

BRITISH COLUMBIA

Canadian Government has been urged by British Columbia and Yukon Chamber of Mines to take "immediate steps" to arrange a meeting with U. S. Government to discuss the proposed establishment of "corridors of commerce" through the Alaska panhandle, which cuts off nearly half of British Columbia from the Pacific Ocean.

Chamber for a long time has spearheaded a campaign for establishment of corridors through the panhandle since it claims the panhandle as it exists is "definitely restricting mining and other industrial developments in northern British Columbia and Yukon territory."

The Chamber's proposal for corridors across the panhandle amounts to a suggestion either that Canada acquire title to some U. S. territory or else get extraterritorial rights on the territory—neither possibility is one likely to be viewed with any favor in the U. S.

O'Brien Gold Mines and New Highridge Mining Co. are embarking on a joint exploration and development program of the Little Bay copper property at Notre Dame Bay. Some 200,000 tons of about 5% copper is reported to have been produced from the Little Bay many years ago. Diamond drilling, done by New Highridge last summer, gave encouraging results.

Ore from Mid-West Copper Co.'s Velvet Mine near Rossland, assayed 1.48 oz gold and 5.6% copper, to measure up to one of the richest copper-gold strikes made in British Columbia in recent years.

The core was taken from the third level on a new intersection and had total gross value of $100.96 over a 2-ft 2-in. width.

The new intersection gives a depth of approximately 300 ft. Cross-cutting has now started on the 3rd level which will intersect the Dick Rowe vein at 8 ft and the Staffhouse vein at 90 ft. This will give four working faces on the 3 level and two on the 7 level.

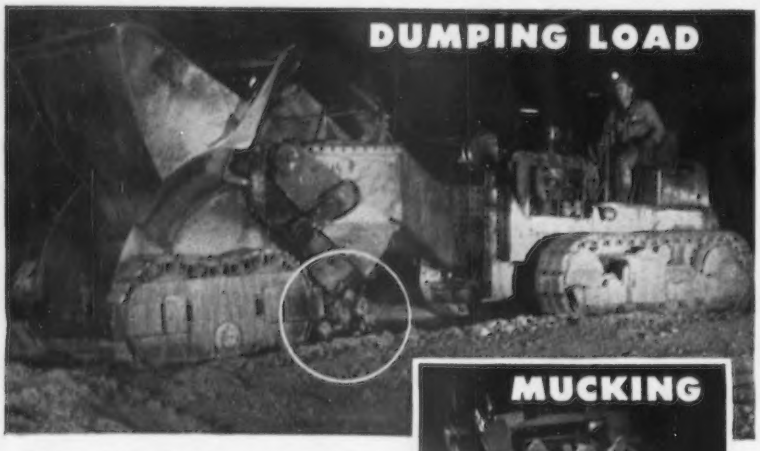
A "heavy water" plant operated by Consolidated Mining and Smelting Co. at Trail for the U.S. Atomic Energy Commission has been closed down.

Closure of the deuterium dioxide manufacturing plant, which cost between $2- and $3-million to build and equip, came after AEC found an alternative process for production of heavy water used in atomic and medical research.

Cominco reports the plant is on its grounds, adjacent to a hydrogen producing plant, a by-product of the company's ammonia manufacture.

A new crusher, capable of handling three times as much ore as the present one, is being installed by Sheep Creek Mines Ltd.

SHOWDOWN WITH MINING COSTS:
Gismo promises big new economies!



IT MAKES POSSIBLE a mining method requiring few machines, few men, less planning and integration—permits total mechanization of your mine. Here's a self-loading transport that is SIMPLE, versatile—mucks in development or production, drills, makes its own roadways, etc. Without question, the extraordinary economies the Gismo Method promises merit thorough investigation by any firm excavating rock or its equivalent. Ask us for complete information. *Sanford-Day Iron Works, Inc., P. O. Box 1511 . . . Telephone 3-4191, Knoxville, Tennessee.*

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"SUPER MARKET FOR MINE CARS" — *all types* * PRECISION WHEELS * "BROWNIE" HOISTS, CAR RETARDERS, SPOTTERS, PUMPS AND OIL SPRAY SYSTEMS * GISMO SELF-LOADING TRANSPORT that loads *(mucks)* in development or production . . . transports . . . supports 2 to 5 jib mounted drills . . . back fills . . . moves boulder rocks . . . makes its own roadways and cleans up completely — a new method of hard rock mining offering a tremendous reduction in cost per ton!

A Balanced Program for Improved Drilling

TEE CEE
(tungsten carbide insert bit)

LIDDICOAT
(used to destruction — no resharpening bit)

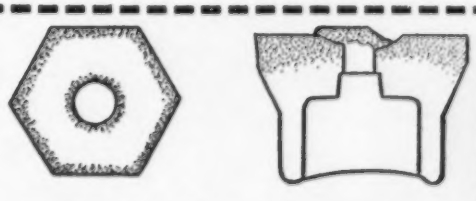
Carburized Drill Rod

To equal the fine drilling quality of Liddicoat bits, a drill rod has been developed to provide much greater footage and consequently lower cost per foot of hole drilled. The drill steel has been carburized to provide a stiff rod with a hardened section on the outside of the steel, and on the inside around the water hole. These hardened sections are supported by a strong ductile core.

Carburizing treatment has been designed to correct weaknesses existing in ordinary steel; namely, surface decarburization and low strength zones. By carburizing and hardening, tendency to fatigue failures, rapid wear in drill rods is lessened. The carburized rod incorporates mechanical and metallurgical refinements heretofore unavailable in drill steel.

⅞" Hexagon is the most popular section for feed-leg drilling. To secure the advantages of this cross section of drill steel, the Liddicoat bit is made in type 3 TEE CEE, 3-L and 3-H — all have the same socket size. Within the socket are forged six flats to match the flats on the rod. The bits are all interchangeable, which provides a type of bit best suited to ground conditions.

A trial order will prove the merit of this balanced combination to your entire satisfaction.



Dots in sketches indicate the hardened portions of cross section of drill rod and hardness pattern of Liddicoat bit.

WESTERN
Rock Bit Manufacturing Company
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IMPOSSIBLE WITHOUT EXPLOSIVES

The modern highway—wide and spacious with increased visibility and no cross traffic—is a tribute to modern construction techniques. The above section of U.S. 99 between Bakersfield and Los Angeles, California, is a good example of engineering know-how. Where rock was encountered, blasting crews with Hercules explosives took over.

For more than forty years, Hercules has engaged in continuous research into the development of explosives materials and improved blasting techniques. Whether your requirements are for construction, mining, quarrying, seismic prospecting, or in other fields where explosives are needed, Hercules technical representatives will be glad to assist in the selection of the right materials for the most efficient job.

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XR56-2

B.F.Goodrich

How tires last over 4,400 hours in rugged coal mining work

THE Carbon Fuel Company operates 40 units in its coal mining work in Kanawha County, West Virginia. Trucks haul slate, slag and other coal refuse, with loads often reaching 29 tons, over rugged mining roads. Tires take a terrific beating on a job like this.

But Carbon Fuel uses B. F. Goodrich Universal and Rock Logger tires, reports as much as 4,438 hours of service from them! Says Purchasing Agent W. M. Brackenridge, "They give us better traction and less down time."

B. F. Goodrich Universal and Rock Logger tires are specially compounded to resist rock cuts and bruises. The extra-thick tread has husky cleats that dig in and pull. And under the tread you can get the B. F. Goodrich *all-nylon* cord body. It withstands double the impact of ordinary cord materials, resists heat blowouts and flex breaks. No wonder the B. F. Goodrich *all-nylon* body outwears the tread, *can be recapped over and over!*

Why not follow the lead of mine operators all over the country and switch to B. F. Goodrich tires. See your nearby B. F. Goodrich retailer today or write *The B. F. Goodrich Co., Tire & Equipment Div., Akron 18, Ohio.*

TONS OF SLAG pour onto this truck equipped with B. F. Goodrich Rock Logger tires at Carbon Fuel Co. mine near Carbon, W. Va.

"WE PREFER the Universal tread over any other," says Roy J. Ault, Superintendent of Shasta Coal Corporation, Bicknell, Indiana.

Specify B. F. Goodrich tires when ordering new equipment

RESEARCH KEEPS B.F.Goodrich FIRST IN RUBBER

Your B. F. Goodrich retailer is listed under Tires in the Yellow Pages of your phone book

British Columbia *(Continued)*

at its Mineral King lead-zinc mine in East Kootenay.

Toward the end of 1955 an entirely new ore zone was contacted at the mine.

The company reports excellent progress in opening a new haulage level 750 ft below the present lowest level. The new level is just above the mill horizon and will effect substantial savings in ore handling.

Results of exploration on the second level of Yreka Mines Ltd. on Quatsino Sound on Vancouver Island, have justified immediate production, according to a statement from the company. While not sufficient to fully clarify the outlook, drilling on the 1900-ft level has proven up substantial ore, and an indicated 300-ft ore length with indicated average width of 20 ft, has given a grade in muck samples of about 5% copper, the announcement said.

NORTHWEST TERRITORIES

Zones of untapped heavy mineralization in Canada's Northwest Territories will be opened up with the "inevitable" improvement of transportation, according to NWT District Administrator L. A. C. O. Hunt.

Hunt addressed the first annual convention of the Northwest Prospectors and Developers Assn. held March 3 in Edmonton under auspices of the Alberta and Northwest Chamber of Mines. It was attended by more than 100 miners, prospectors, engineers and geologists from the Northwest Territories, the Yukon, Colorado, British Columbia and Calgary.

In addition to Hunt, featured speakers were C. E. Gordon Brown, chief geologist, Giant Yellowknife Gold Mines, Yellowknife; Prof. E. O. Lilge of the University of Alberta; E. Burk-Gaffney of Sheritt Gordon Mines, Lynn Lake; Dr. A. B. Irwin, geologist with the Federal Department of Northern Affairs and Resources; and Leo Telfer of Consolidated Mining and Smelting Company of Canada, Ltd.

In referring to plans for rail communication from Grimshaw, Alberta, to Great Slave Lake, the NWT District Administrator said:

". . . the building of such a railway would provide the economic stimulation required to exploit and develop the mineralized zone surrounding Great Slave Lake. You are aware of the many known occurrences of orebodies around this Lake. The most recent development is the intense staking activity around Windy Point dominated mostly by Preston East Dome Mines; and it appears to be a continuation of the enormous lead-zinc deposits at Pine Point on the southwest shore of Great Slave Lake . . .

"Notwithstanding the possibilities of a

Not all vapor trails are made by bombers. Fairchild survey crews often fly at altitudes that leave their mark in the sky.

Why fly so high? The cost of compilation in aerial map making is a function of the number of photographs. Also, more area can be covered per hour, thus reducing flying time. This is important when fighting bad weather, and also results in great savings in time and money.

But precision, high-altitude aerial mapping demands more than high flying airplanes. Special precision camera equipment, and highly developed pilot and cameraman techniques are also vital. And the most important ingredient—experience—nearly 40 years of it, goes into every Fairchild survey.

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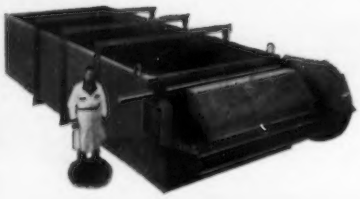

EAGLE 48" LOG WASHER

A heavy duty money maker that will economically abrade and scrub ore, crushed stone or gravel . . . year after year. Handles material up to 8" in diameter . . . capacity to 150 tons per hour (depending upon material size and amount of foreign matter to be removed). Tub is 9'4" wide x 24' or 30' long. Both logs are 48" dia. Sturdy Tubular log shaft . . . no deflection. Enclosed gearing at discharge end as shown.

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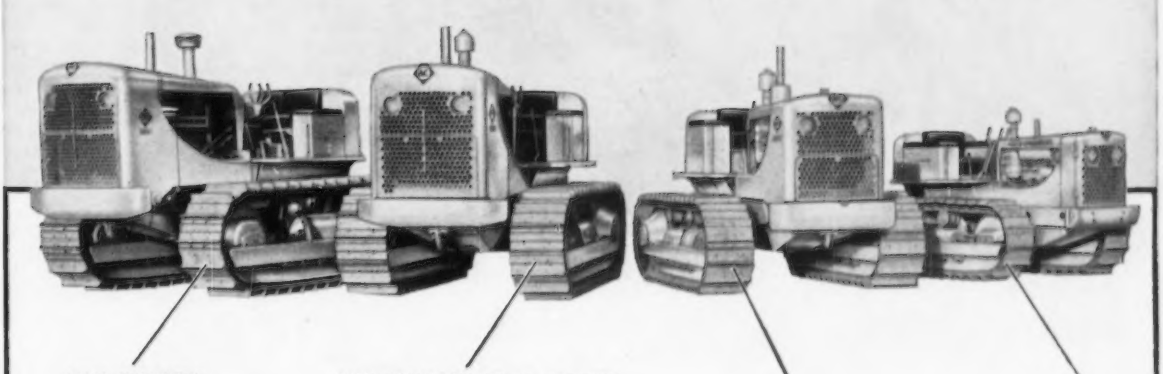
More features you want for high production . . . long life . . . low job costs



ALLIS-CHALMERS HD-21 TORQUE CONVERTER TRACTOR
Hp — 204 net engine
Weight — 44,000 lb
Drawbar pull — up to 65,000 lb

ALLIS-CHALMERS HD-16 TRACTOR

Standard Transmission
Hp — 141 belt
Weight — 31,500 lb
Drawbar pull — up to 37,700 lb

Torque Converter Drive
Hp — 150 net engine
Weight — 31,600 lb
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ALLIS-CHALMERS HD-11 TRACTOR
Hp — 85 belt
Weight — 20,500 lb
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Hp — 55 belt
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HERE IT IS . . . the all-new Allis-Chalmers line of crawler tractors . . . with more of everything you've wanted most for steady output—more work power, more long-life features, more easy maintenance and easy operation features, more versatility in every tractor.

You get all the benefits of Allis-Chalmers advanced basic design with the new Allis-Chalmers diesel engine . . . proved torque converter drive for the HD-21 and HD-16 . . . all-steel box-A main frame . . . unit construction . . . 1,000-hour lubrication intervals for truck wheels, idlers, support rollers . . . double-reduction final drives, and many other profit-producing features.

And there's a complete spread of tractor equipment — hydraulic and cable dozers, heavy-duty winches, hydraulic rippers. You can choose from a full line of tractor shovels ranging from 1½-yd to 4-yd capacity.

Behind this equipment are dealers with sales and service personnel and facilities that assure you expert "after sales" care. The True Original Parts they stock help give you continued top performance and long equipment life.

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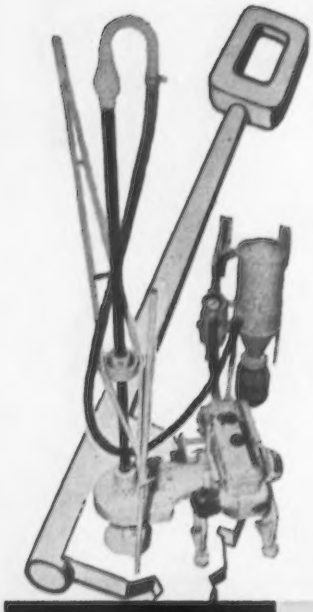

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DRILLS BY VACUUM
No Fuss - No Muss - No Dust

Impossible to lose circulation. Adaptable to geophysical, shot hole, blast hole, rat hole or surface pipe drilling rigs. Drills to 2000 feet. Removes cuttings at rate of 1 to 36 tons per hour.

MIGHTY MIDGET PORTABLE DRILL

- Weighs 125 lbs.
- Drills by vacuum — no water needed. 100% recovery of cuttings.
- Impossible to lose circulation. Powered by McCulloch 9 H.P. engine.
- Ideal for exploration drilling.
- Anywhere there is a hole to be drilled the Mighty Midget will drill it.
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A PRODUCT OF THE HOUSTON TOOL CO

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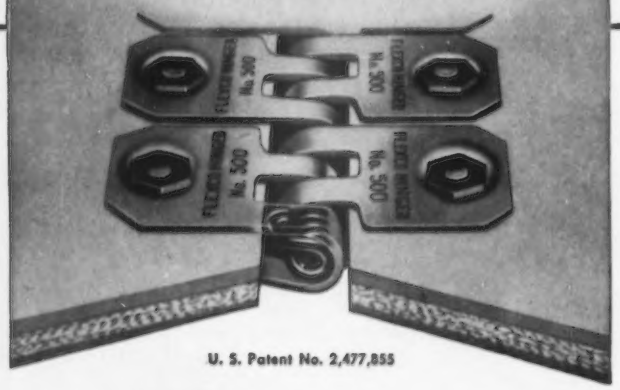
FLEXCO HINGED BELT FASTENERS



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- For joining underground extension conveyors.
- A FLEXCO fastener that is HINGED. Has removable hinge pin.
- Troughs naturally, operates smoothly through take-up pulleys.
- Strong, durable . . . pull or tension is distributed uniformly across joint.
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FLEXIBLE STEEL LACING CO. 4635 Lexington St., Chicago 44, Ill.

N.W. Territories *(Continued)*

railway, road communication is inevitable. This year a further development of the Mackenzie Highway is planned and $1-million set aside for this purpose.

"This road when completed (a three-year program) will enable vehicular traffic to drive direct from Edmonton to Yellowknife. The economic possibilities of this road are enormous. Cheap road freight all year round to Yellowknife would mean lower inventories in the mines and a saving in carrying charges."

In this regard, he pointed out that with a decreased cost of production at the mines, other marginal properties may be encouraged to begin operations.

Technical sessions of the one-day convention were opened with an address—"Geology at Giant" by chief geologist Brown. He said that "prospects are exceedingly bright" at Giant Yellowknife where, to date, 1.5-million tons of ore have been milled. Present rate is 840 tpd.

Brown pointed out that "Giant" has become the fourth largest gold producer in Canada within six years. The mine has been in operation for eight years only.

The Pine Point Mines were described by Telfer of the Consolidated Mining and Smelting Company of Canada Ltd. His paper stated in part:

". . . development has increased the open pit ore from 500,000 to over 5-million tons grading 4% Pb, 7.4% Zn with additional large tonnages of underground ore. Last season a shaft was sunk to get some information on underground mining conditions, water problems, etc. About 183,000 ft of diamond drilling was done and $2.25-million spent on this program since it was started in 1948."

Telfer told the convention:

"It is of interest at this time to see how close to the initial base line all the known mineralization lay and to recognize that by a geologically guided program this major lead-zinc field was outlined at a cost of about $2,200 per claim."

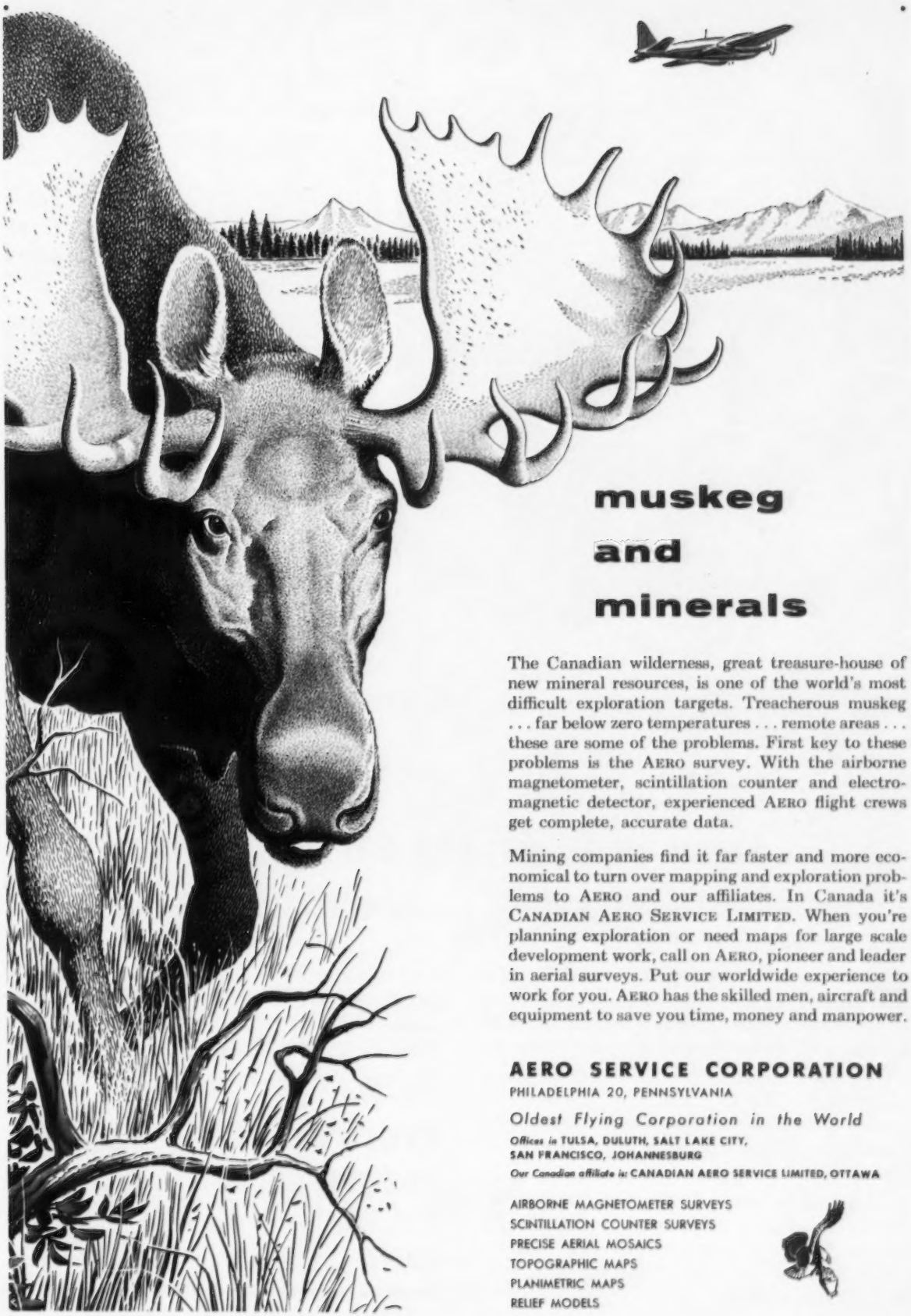
SASKATCHEWAN

Saskatchewan has entered into an agreement with the Potash Co. of America for the development and production of magnesium from 100,000 acres about 75 miles northwest of Regina. The agreement, first of its kind to be made, covers 10 years at an annual rental of $10,000.

The company is committed to studies which will determine the feasibility of establishing a magnesium industry in the province. No fixed rate of royalty is established for magnesium although any potash produced as a co-product will be subject to existing royalty rates.

Presence of magnesium salt in the area was established when the company was prospecting for potash. After passing through a thin section of potash and some common salt, the drill encountered a substantial thickness of carnallite as an ore mixture of carnallite and common salt.

Canadian production of metallic magnesium is about 6,000 tons annually, all recovered from a magnesium-bearing limestone. None is recovered from sea water as in the United States.



muskeg and minerals

The Canadian wilderness, great treasure-house of new mineral resources, is one of the world's most difficult exploration targets. Treacherous muskeg . . . far below zero temperatures . . . remote areas . . . these are some of the problems. First key to these problems is the AERO survey. With the airborne magnetometer, scintillation counter and electromagnetic detector, experienced AERO flight crews get complete, accurate data.

Mining companies find it far faster and more economical to turn over mapping and exploration problems to AERO and our affiliates. In Canada it's CANADIAN AERO SERVICE LIMITED. When you're planning exploration or need maps for large scale development work, call on AERO, pioneer and leader in aerial surveys. Put our worldwide experience to work for you. AERO has the skilled men, aircraft and equipment to save you time, money and manpower.

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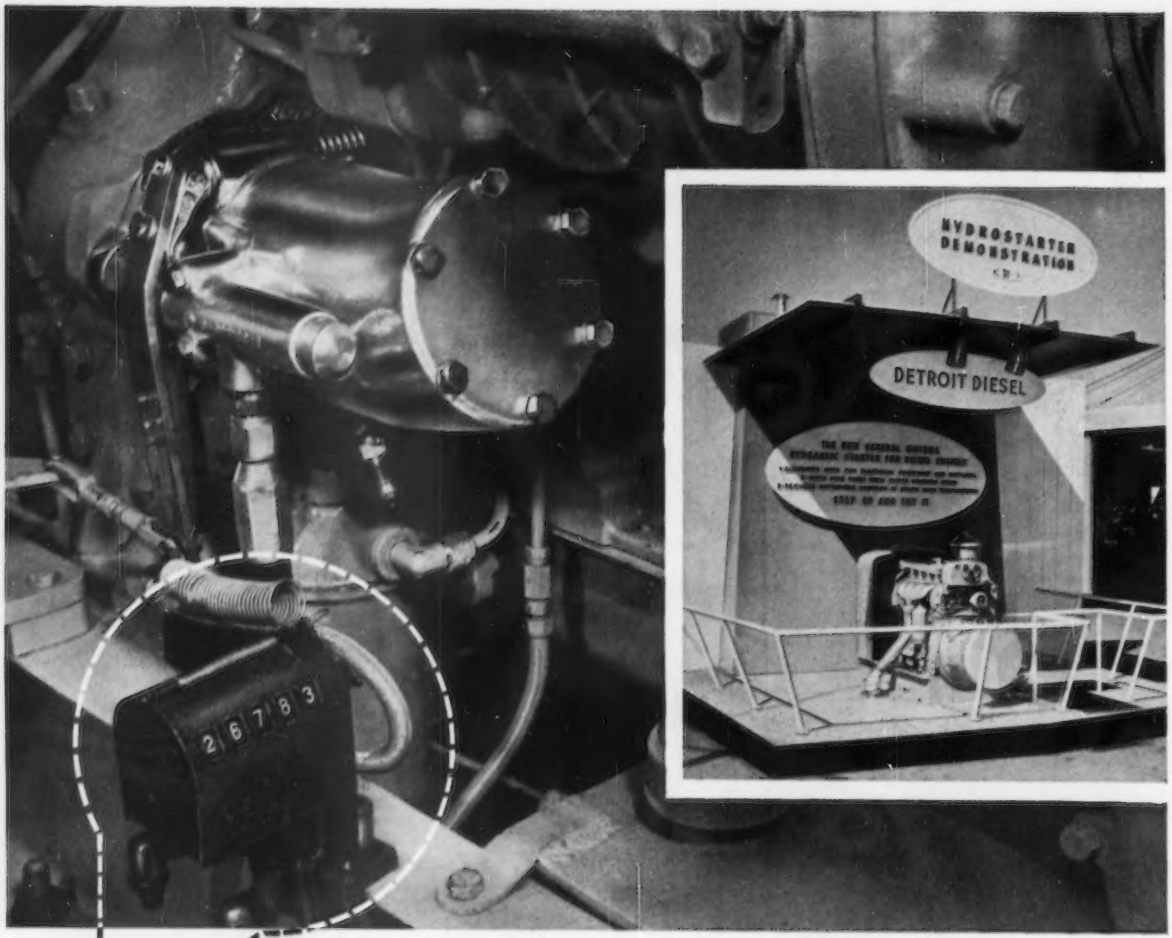

26,783 Starts in 26 days at GM Powerama!

(and the total is still growing at the GM Motoramas!)

HERE'S PROOF of the rugged dependability of a General Motors Hydrostarter—the new, low-cost hydraulic starting system now available on all GM Detroit Diesel engines:

> On public demonstration at the GM Powerama, a Hydrostarter started a GM Detroit Diesel 26,783 times in 26 days—an average of more than 1,000 starts per 12-hour day—more than 1 start every minute.

A Hydrostarter gets a GM Detroit Diesel up to starting speeds 80% faster than regular starting systems—costs less to maintain than electric starters—sells for a far lower price than any other non-electric Diesel starter.

And it gives you fast, sure starts—even at sub-zero temperatures, or when your equipment has been standing idle for long periods of time.

Call your GM Diesel Distributor for full details on the GM Hydrostarter—or write direct for more information.

DETROIT DIESEL

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Single Engines . . . 30 to 300 H.P.
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America's Largest Builder of Diesel Engines

Why brute loads don't "bust" this screen

● Here's a screen built to take abuse . . . a screen specifically designed to handle large quantities of *big, heavy* rock and ore.

The main frame of this powerful PIONEER Mesabi Vibrating Screen is built from 18" car channel or I-beams and reinforced with 8" wide flange cross beams. Screen frames are constructed from extra-heavy channels, pipe, angles, and bars. Pan side thicknesses range from ¾" to ½", depending on size of screen. Angle bracing at critical points adds further strength and rigidity. Beefed-up shafts are built to take it.

EFFICIENCY. PIONEER Mesabi screens are not only rugged, but you just can't beat them for fast, accurate separation.

That's because PIONEER's full circle, forward throw agitation produces an identical, positive motion from one end of the pan to the other. Every inch of this screen works for you.

Near-perfect balance is maintained by placing the shaft at the pan's exact gravitational center and counterbalancing the flywheels to offset the throw of the pan. This gives precise end-for-end, top-for-bottom balance at all times. Since vibration is confined to the pan and not transmitted to the frame, less power is needed and equipment lasts longer.

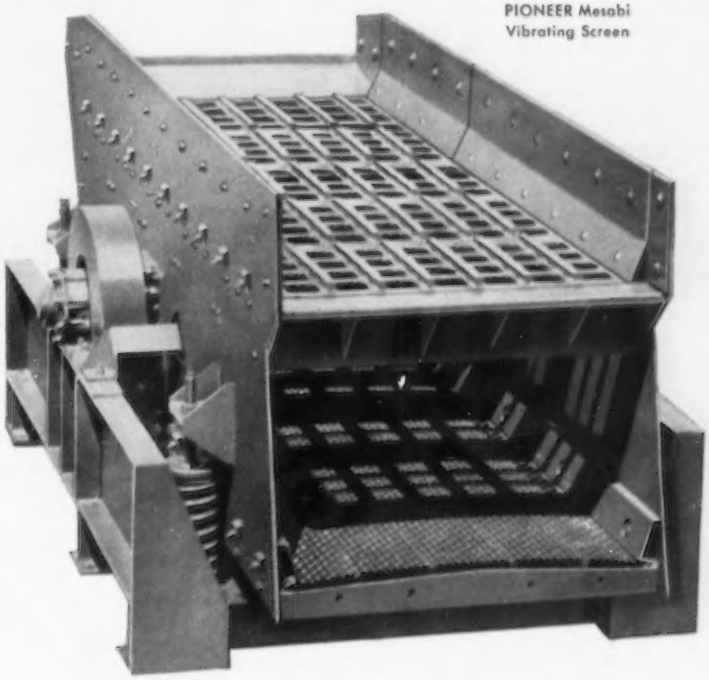
OUTPUT. PIONEER screens are known for their extra capacity. Positive throw, down-hill agitation, and use of the entire screen surface, combine to deliver maximum tonnage.

SPECIFICATIONS

Size	Horse-power	Approximate weight in pounds		
		1 Deck Scalping	2 Deck Scalping	2-Deck Gradation
4'x10'	15	8,900	8,800	8,000
4'x12'	15	10,000	10,000	9,100
5'x10'	20	11,800	11,800	11,000
5'x12'	20	12,800	12,700	12,000
5'x14'	25	13,700	13,600	13,000
6'x12'	30	14,550	14,200	13,800
6'x14'	30	15,800	15,300	14,900

Ask your screen salesman these questions

1. Will frame resist sagging and twisting under heavy loads?
2. Is vibration effectively confined to pan?
3. Do both ends of screen vibrate equally with the middle?
4. How efficient, percentagewise, is separation?



PIONEER Mesabi Vibrating Screen

For detailed features, specifications, and performance data, write Pioneer Engineering Works, Inc., Minneapolis 13, Minnesota, or see your nearest PIONEER Distributor.

BUY BOTH! HIGHER OUTPUT LOWER UPKEEP

Pioneer *Continuflo* EQUIPMENT

Pioneer Engineering Works, Inc., 1515 Central Ave., Minneapolis 13, Minn.
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Please send information on equipment checked.

- ☐ GRAVEL PLANTS
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- ☐ ROCK PLANTS
- ☐ BITUMINOUS PLANTS
- ☐ VIBRATING SCREENS
- ☐ JAW CRUSHERS
- ☐ APRON FEEDERS
- ☐ BUZZER SCREENS (LIGHT DUTY)
- ☐ ROLL CRUSHERS
- ☐ ORO FEEDERS
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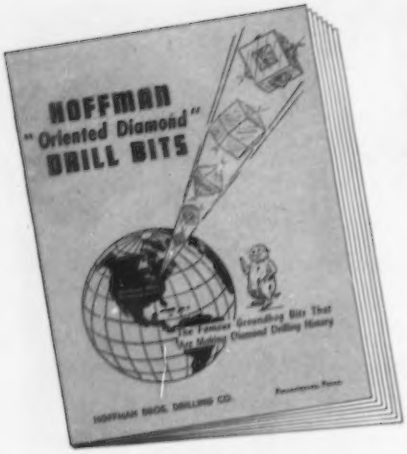

Find Out How HOFFMAN BITS Save You Money

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See how Hoffman Research is producing many other, almost unbelievable advancements in bit design like the Tapered "Step Core" and Miniature Bits shown here. The new Miniature Bits are reducing prospecting labor and costs because they operate from light, ¼ h.p. rigs. By combining drilling and reaming into one operation, the "Step Core" Bits penetrate faster—simplify core recovery—have high speed water release. Yes, it will pay you to find out why so many other drillers are getting better cores, lower footage costs and faster penetration with Hoffman "Oriented Diamond" Bits.

Hoffman Drilling Crews are also available for fast, efficient service on Contract Drilling Jobs.

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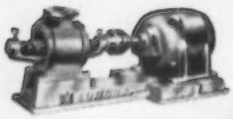
"TOPS" by EVERY TEST

Capacities to 150 G.P.M.



Heads to 600 Ft.

APCO Two Stage Pump for High Pressure Service

APCO is the highest development of the Turbine-Type Pump. Unsurpassed for small capacity high head duties. Handles non-lubricating liquids almost indefinitely without wear. Suited to "1001" duties. Write for Bulletin 111 or Condensed Catalog "M".

STAINLESS STEEL APCO PUMPS

We carry representative sizes of APCO's in stock in No. 316 Stainless Steel for prompt shipment.

Write for CATALOG "M"

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AURORA® PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
86 LOUCKS STREET • AURORA • ILLINOIS

IN THE PHILIPPINES

Philippine Bureau of Mines estimates that total value of the Philippine mineral production in 1955 totalled $83.5-million. The mining industry had a capital investment of about $102-million and employed at least 25,000 people. More copper, chromium, and iron were produced in 1955 than at any time in the history of the country's metal mining. The country ranks seventh as a world gold producer, and is now the biggest copper producer in the Far East.

A representative of Elizalde & Co., operators of Marinduque Iron Mines and Samar Mining Co. is arranging for purchase of machinery and equipment for a flotation mill for the Sipalay copper project in Marinduque. Proposed mill will have a capacity of 4500 tons of copper concentrates per month.

Atlas Consolidated Mining stepped up its January production 17% to 153,620 tons milled, establishing a new record. Mill heads averaged 0.77% copper.

Itogon Mining Co. in Baguio is milling 500 tpd gold ore, averaging about 0.2 oz gold per ton. The company paid its first post war dividend in January.

Under direction of Nestorio N. Lim, mining engineer for Surigao Consolidated, an energetic prospecting campaign has been conducted throughout the Islands for new development projects for the company. Copper deposits were inspected in Ilocos Norte province as well as in Nueva Eceja, Masbate, Cebu and Jolo. Many high grade copper showings were encountered, but prospective tonnages are not large. Transportation is difficult.

A re-survey and re-sampling of the Lingig silver-barite deposit in southern Mindanao indicates higher silver and gold values than reported 16 years ago by engineers of the Bureau of Mines at that time and development may be undertaken. In Zambales Province the company is sinking on a promising copper prospect with a series of shafts.

C. A. Mitke recently returned to the Philippines from the U. S. and is developing a wide sulphide vein in Millagras, Masbate, which can be traced for 2,000 ft. The property has been worked off and on since 1920 and has considerable promise.

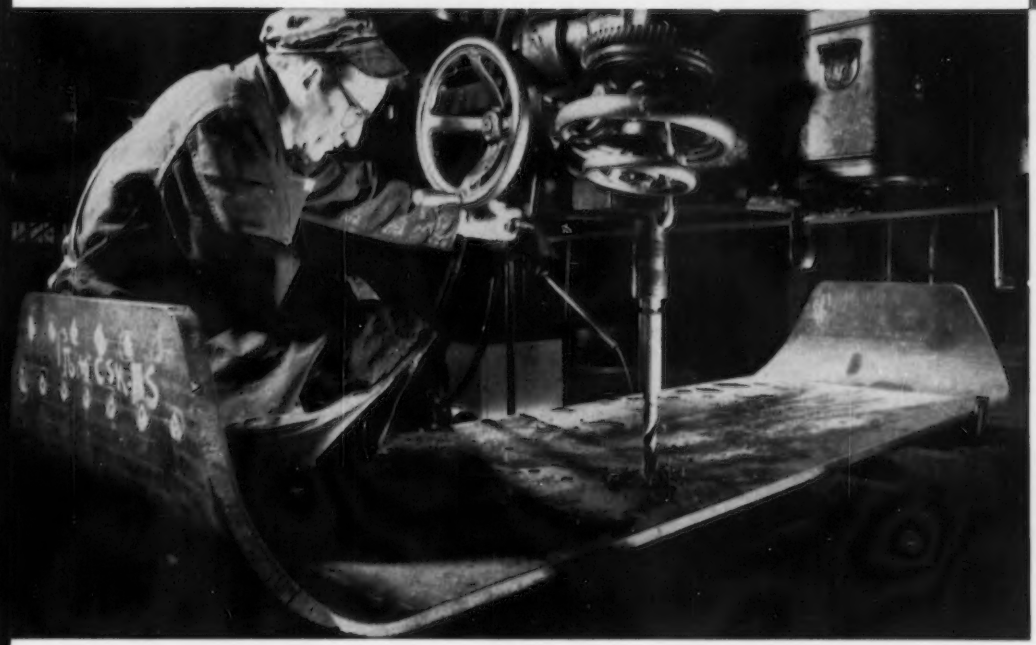
For its fiscal year ending Sept. 30, 1955, Philippine Iron Mines operating its property at Larap, Paracale, delivered 1,020,058 metric tons of iron ore to Japanese steel mills under contract. Receipts from sale of ore totalled $8,654,000 at prices of $8.60 per ton for lump ore and $6.10 for sintered ore. An agreement has been made with the same mills for the sale of 6-million tons over a 5-year period. In connection with this contract the steel mills will assist the company by a $1.8-million loan to construct a beneficiation plant at Larap. Deliveries of ore will begin as soon as the plant

In ore clean-up buckets

FABRICATION SIMPLIFIED WITH USS "T-1" STEEL

(and weight reduced more than ½ ton)

This photo courtesy of Blaw-Knox Company.



HALF AS THICK! In the trays for giant ore clean-up buckets, 1¼" USS "T-1" Steel Plate, with a yield strength of 90,000 psi., replaces cast trays which were as much as 2½" thick. The new buckets—lighter in weight by more than half a ton — and expected to outperform the heavy cast trays, will be used at United States Steel's South Works.

UNITED STATES STEEL CORPORATION, PITTSBURGH
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION,
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

• The trays of ore clean-up buckets must have phenomenal shock and abrasion resistance to hold up under constant scraping and scouring along the steel bottoms of ore boats. They are commonly made of heavy steel castings. But recently, Blaw-Knox Company, Pittsburgh, Pa., *fabricated* trays for several new buckets from USS "T-1" Steel Plate. This amazing new alloy steel assures the needed strength and durability, plus important fabricating advantages.

LESS WEIGHT — LESS EXPENSE

Biggest single advantage of fabricating from "T-1" Steel Plate is less weight. New trays weigh only 4,021 pounds each, compared to 5,068 pounds for comparable cast manganese steel trays. Thus, "T-1" decreases the weight of the bucket and reduces shipping and handling costs.

What's more, fabrication from "T-1" simplified the building of these huge buckets. It eliminated the expensive patterns needed for cast trays. Because "T-1" has tremendous resistance to impact abuse and abrasion, it is expected that it will outperform previously used materials.

For these ore buckets, "T-1" Steel is flame-cut to size, *cold formed* in a 1,250-ton press, drilled and then riveted to the bucket shell. "T-1" also can be welded—without pre- or post-heating. Because of its unusual combination of properties, it is cutting costs in many rugged applications.

LOOK AROUND YOUR SHOP

In your own equipment, or in the products you make for others—wherever you would like to increase service life . . . wherever you would like to reduce fabricating costs of heavy-duty parts—look into the possibility of using "T-1" Steel. Competent technical advice is always available, of course — free of charge — from United States Steel. Write, wire, or phone for complete information. United States Steel, Room 521I, Pittsburgh 30, Pa.

USS "T-1" CONSTRUCTIONAL ALLOY STEEL

USS

UNITED STATES STEEL

Withstands far greater

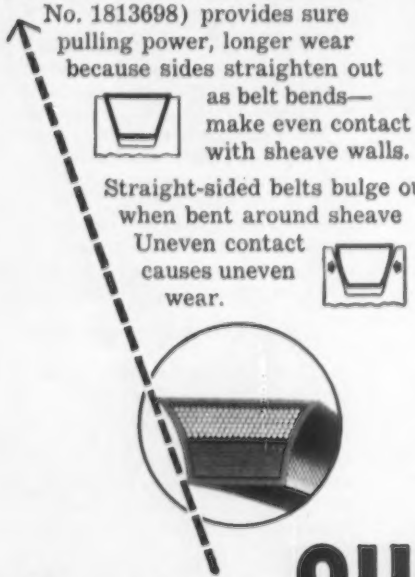
SHOCK LOADS

than any standard V-belt

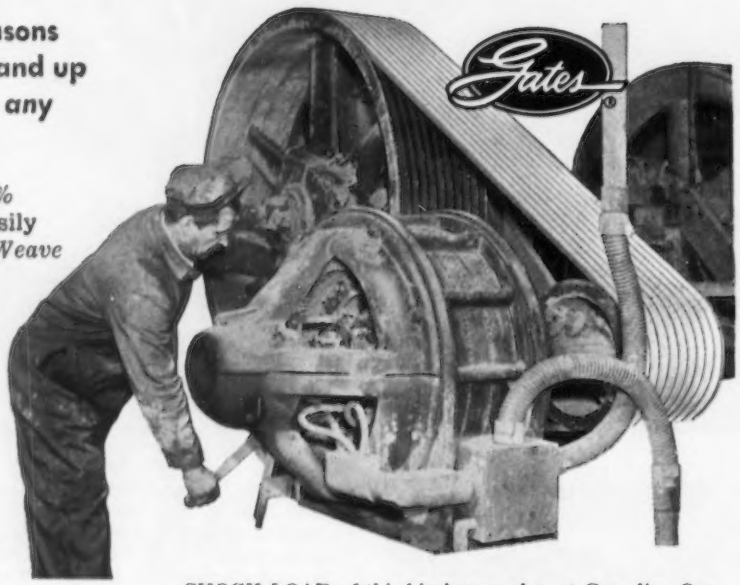
Here are the interesting reasons why Gates Super Vulco Ropes stand up months, even years longer than any standard V-belts...

1. *Super-Strength Cords* provide 40% greater horsepower capacity . . . easily absorb heavy shock loads. **2.** *Flex-Weave Cover* (U.S. Pat. No. 2519590) provides greater flexibility with far less stress on the fabric. Cover wears longer — increases belt life, lowers belt costs.

3. *Concave Sidewalls* (U.S. Pat. No. 1813698) provides sure pulling power, longer wear because sides straighten out as belt bends— make even contact with sheave walls.



Straight-sided belts bulge out when bent around sheave. Uneven contact causes uneven wear.



SHOCK LOAD of this big jaw crusher at Canadian Quarries, Ltd. is absorbed by Gates Super Vulco Rope Drive. Wherever shock load is severe, Gates Super Vulco Ropes cushion the shock—keep machinery replacement cost down.

3 other outstanding advantages

Resists Oil, Heat and Weather: Long life is assured even in the presence of excessive oil . . . even under prolonged exposure to heat and weather.

Provides Static Safety: The high electrical conductivity of Gates Super Vulco Rope provides safer drives in explosive atmosphere.

Saves Space: Higher horsepower rating and greater resiliency may permit fewer belts, or smaller sheaves where space saving is vitally important.

The Gates Rubber Co., Denver, Colorado
World's Largest Maker of V-Belts

Gates SUPER Vulco Rope

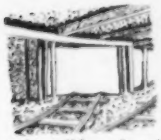
The V-Belt with 40% more horsepower capacity

TPA 57

THE
OUTSTANDING
MINE VENTILATION
LINE

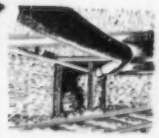
Outstanding
✓ FOR QUALITY
✓ FOR DEPENDABILITY
✓ FOR COMPLETENESS

ABC BRATTICE CLOTH



7 types to fit all needs—3 types of jute cloth, 2 types of cotton, plastic and Black Ace for non-gaseous mines. Carefully processed to resist flame, except Black Ace, and to resist mildew. In widths and lengths for any seam.

MineVent



FLEXIBLE VENTILATION TUBING

Made in two grades; the jute base and cotton base, synthetic rubber coated. Resists leakage, abrasion and moisture. Available in 9 diameters, 8" to 36" and 25, 50 or 100 ft. lengths. Choice of 3 types of suspension, demountable patented Snap-On coupling or Sewed-In coupling. Most widely used mine ventilation tubing.

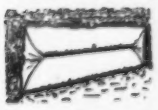
NEOLON FLEXIBLE VENTILATION TUBING

The new Neoprene coated Nylon fabric tubing. Almost impossible to tear. Airtight. Resistant to abrasion, acid mine water and flexing. Same lengths and diameters as MineVent.

NON-COLLAPSIBLE TUBING

Both MineVent and Neolon are available with telescoping spring wire inserts rendering the tubing non-collapsible. Light weight. Economical.

ABC INFLATABLE BRATTICE



Sizes to fit any opening. Readily fills rough contours, jagged walls, etc. Quickly inflated by special hand pump. Quickly deflated to move to new location. Easy to transport. Economical to use.

ABC POWDER BAGS

Rubber coated durable fabric, firmly sewed, for long use and hard wear. 5 sizes: 20, 36, 60, 125 and 160 sticks of explosive.

Send for Catalog 55.

A B C AMERICAN BRATTICE CLOTH CORP.
WARSAW, INDIANA

220 So. Buffalo St., Warsaw, Indiana

Philippines (*Continued*)

is in operation, expected to be about the end of 1956. Positive and probable ore reserves are estimated in excess of 20.3-million tons grading 50% iron.

Acoje Mining Co. plans to increase its output of chromite from 6,000 to 10-12,000 tons of concentrates a month. A high tension magnetic separator will be installed in March to improve the grade of concentrates.

December production at the Toledo copper mine in Cebu totalled 3,290 tons of concentrates averaging 21.4% copper, or a total of 1,409,000 lb copper and 394 oz gold. The mill treated 130,-564 tons of ore, highest monthly record since operations began in March 1955. Continued high copper prices have permitted milling low grade oxidized surface ore, and average grade milled dropped to 0.7% copper in consequence.

IN LATIN AMERICA

ARGENTINA

National Lead Co.'s newly installed flotation and concentration plant at the "Castaño Nuevo" mines, province of San Juan, was expected to commence production last month. With an annual capacity of 6,000 metric tons, plant output is destined for the company's foundry in Puerto Videla, province of Chaco. Until now National Lead operated the lead foundry, and for most of its supplies it depended on the mines of Cia. Minera Aguilar, S.A. Following Aguilar's mines, National Lead now operates Argentina's second largest deposits of lead, zinc and silver, and its new plant investment represents the largest of its kind in recent years.

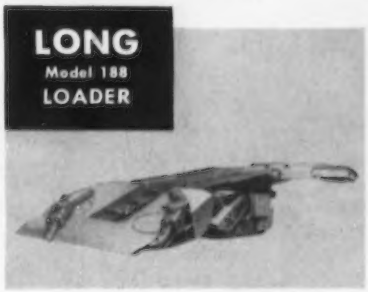
National Mining Administration continues to be active in exploratory work on the Agua Tapada gold mines in Catamarca Province, the largest gold deposits so far known in the country. Property of the National University of Tucumán, these mines were originally explored by the university. Later NMA took over exploration and development almost 1,000 meters of galleries up to a depth of 170 meters. Experimental concentration is done with a small Gardner-Denver plant and the NMA program is to further this work until Agua Tapada's potential reserves are more accurately determined.

Among NMA's main activities this year is the conducting of geological surveys of the country's leading tungsten mines in San Luis, Córdoba, Catamarca, La Rioja and Rio Negro. With some 300 such deposits existing throughout the country, the program on this work is scheduled for completion by the end of this year, when the government expects to have a more representative picture of the tungsten potentialities requiring future development.

Designed To Outperform Anything On The Market...

Two Great LONG Loaders

A low height, heavy-duty machine capable of continuous high-capacity operation, the LONG Model 88 Pigloader*, has been developed specifically for Piggy-back* Conveyor Mining. It's built extra rugged to withstand hard usage, yet is readily maneuverable and simple to operate. Rated capacity: average—4 tons per minute; maximum—6 tons per minute. Height 26".



Equipped with a swing boom for loading into shuttle cars, this new loader offers the same superior operating features as the Model 88. Extensive operating tests indicate that the Model 188 will outperform any loader in its class on the market today. Rated capacity: average—4 tons per minute; maximum—6 tons per minute. Height—28".

*Trade Mark

The LONG Design Features A Single 40 hp Electric Motor

- Simplicity of electrical circuit
- Less maintenance
- Permits full power for any single machine operation

For complete details or a demonstration, write us today.

The LONG Company
OAK HILL, W. VA.

Athey MON for

PROFITS IN TRACTOR-TRAILER MANEUVERABILITY

Athey-Cat Tractor-Trailer maneuverability in the Athey PH20-Cat DW20 means faster cycles, higher production and bigger profits. More maneuverable than rigid frame haulers, this rugged team, with articulated universal joint design, gets under shovels, over grizzlies or hoppers quicker . . . handles easier and faster in tight, narrow quarters . . . and takes sharper turns at higher, safer speeds.

FASTER CYCLES WITH NON-STOP DUMPING

"On-the-go" dumping and high speeds clip cycle time, provide more economical one-way traffic, increase production. Exclusive Athey stabilizing jacks in the PD20 Side Dump Trailer assure built-in safety while dumping. Fills are compacted with big tires . . . material is evenly distributed. Matched in design and performance, the PD20 is built specifically for the Cat DW20 Tractor.

EY MAKERS

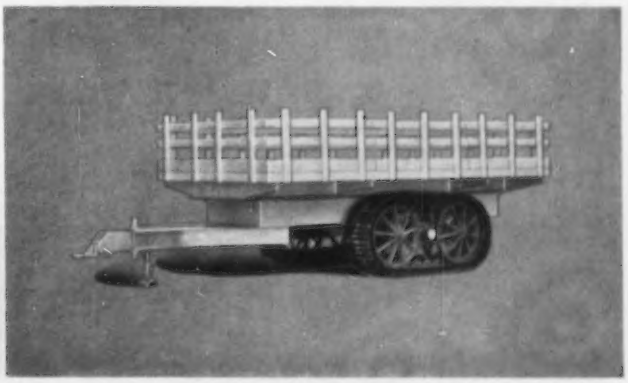
Bigger MINING Profits!

TOP SPEED AND MANEUVERABILITY

Newest of the Athey-Cat Tractor-Trailer units is the fast PR15-DW15 Rear Dump Team. As maneuverable as a pickup, the 22-ton capacity PR15 is easy to spot in seconds under shovels, in restricted areas "off limits" to conventional haulers.

BIG PAYLOADS, BIG PROFITS FAST

Big, wide target with low height make it easy for shovel or dragline operators to get full 22.5 yard payloads fast in the Athey PR21. Non-stop turns in 34 feet . . . hydraulic boosted steering and big single tires permit speed and safety, dumping at fill.



FASTER LOADING, LESS SPOTTING TIME

Patented, full-floating feeder of the Athey 125 HiLoader digs into stockpile, loads wide variety of material. Swiveling conveyor loads trucks at left, right or behind . . . saves spotting time, cuts delays. Loads 10 cubic yards of material per minute.

GOES ANYWHERE TRACK-TYPE TRACTORS GO

The Athey Universal Forged-Trak Trailer gives 14 possible combinations to haul up to 60 tons in toughest conditions. Hauls bulky loads and long loads up to 56 feet in length. Matched to your needs with stake or platform bodies, rubber or steel-wheeled front gear.

ATHEY PRODUCTS CORPORATION, 5631 West 65th Street, Chicago 38, Illinois

"NO MORE LUBRICATION TROUBLES"

—says STEPHENS-ADAMSON MFG. CO.
Conveyor Mfr., Aurora, Ill.

"LUBRIPLATE Lubricants satisfy the 'one-shot' requirements of our conveyor idlers. LUBRIPLATE effectively lubricates each bearing in turn and flows through the hollow shaft to the next bearing. We do not know of a single case of bearing trouble through faulty lubrication where LUBRIPLATE has been used."

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE

LUBRIPLATE LUBRICATION

MAKES CARS AND TRUCKS RUN BETTER AND LAST LONGER

LUBRIPLATE H.D.S. MOTOR OIL . . . THE OIL THAT NEEDS NO ADDITIVES

For nearest LUBRIPLATE distributor see Classified Telephone Directory. Send for free "LUBRIPLATE DATA BOOK" . . . a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

CHILE

Compañía Minera Cerro Negro whose mine and mill are in Central Chile, has taken an option on the Pintadas copper mine located in the Copiapó region. Pintadas is a well known disseminated deposit.

Braden Copper Co. has received for the 8th successive year the Safety Award given annually by the Interamerican Council of Safety for having the lowest accident rate among the mining companies of this hemisphere. On this account, the Chilean National Safety Council also gave Braden Copper a special stimulus for having obtained such a distinguished record.

The Under Secretary for Foreign Affairs has announced that soon a search for uranium minerals will be carried out in the country and that U. S., Canadian and German companies are interested in exploiting in Chile uranium mines. He said also that the construction of an uranium mill is under consideration. Prevalent idea is the formation of a government Agency by the Mining Credit Bank, the Corporación de Fomento (Chilean RFC) and the National Smelters Enterprise that will undertake prospecting, mining and concentration of uranium ores with fiscal funds.

MEXICO

Great interest is centering around a tin mine in Durango which holds promise of being a major property. All will depend on the amount of ore reserves which can be proven.

The mine, El Diablo, is in the Sierra Madre Occidental about 30 miles northwest of Durango. It is being worked by Compania Minera Colorado.

This month a 40 tpd gravity separation pilot mill is expected to go into operation to process development ore. If reserves prove adequate, plans call for a larger mill and a smelter.

There is vein development of cassiterite and exploration activities reportedly have drifted about 200 ft along the vein structure. Assays reportedly run up to 2% but samples as high as 55% have been found. Late in March the company brought in two diamond drills to carry out a program of surface exploration. Drills are capable of coring to 1,000 ft.

Although the property has been known about for decades, there was little organized action until Tom Patten, oil man, and William G. Pickens, contractor, both of Houston, denounced the property about two years ago. M. H. Marr, a Dallas oil man, holds an interest in the company also.

Yielding sets have proven successful in heavy swelling bentonitic ground at Santa Rosalia in the Territory of Baja California del Sur. Heavy timber supports formerly lasted about six months but the yielding sets are expected to last a full year, according to Compania Minera Santa Rosalia.

Genesis of the copper deposit at Santa Rosalia has intrigued geologists for years. Some claim it is sedimentary; others cling to the theory that it was hydrothermal deposition. Ore itself is a mixture of silicates, carbonates and sulphides. Controversy as to the origin of the deposition still is underway and a field trip to Santa Rosalia has been organized for visiting geologists in connection with the 20th International Geological Conference to be held in Mexico City in September.

Since September 1954 two new orebodies have been discovered by a continuous program of surface drilling.

A method of long-wall retreat mining is used to claim the ore. About 200 tpd of ore is smelted to produce about six tpd of blister copper which is sold to a New York brokerage firm.

Santa Rosa, a mercury mine 35 miles southwest of Cuernavaca, began production early this month at a rate of 45 flasks a month.

An old Spanish mine, Santa Rosa is now being operated by Bernardo de Mexico, S. A., of which Bernardo Bennett is president. Bennett estimates that there is a two-year reserve supply of cinnabar and in addition there is about a 15,000-ton mine dump which can be commercially reworked.

Cinnabar is crushed, roasted in a 20-tpd-capacity retort then mercury vapors are condensed and purified. The operation includes a 17 kw diesel power unit and all firing is done by diesel and air jets. Some 55 men are employed. All production will be exported to the United States.

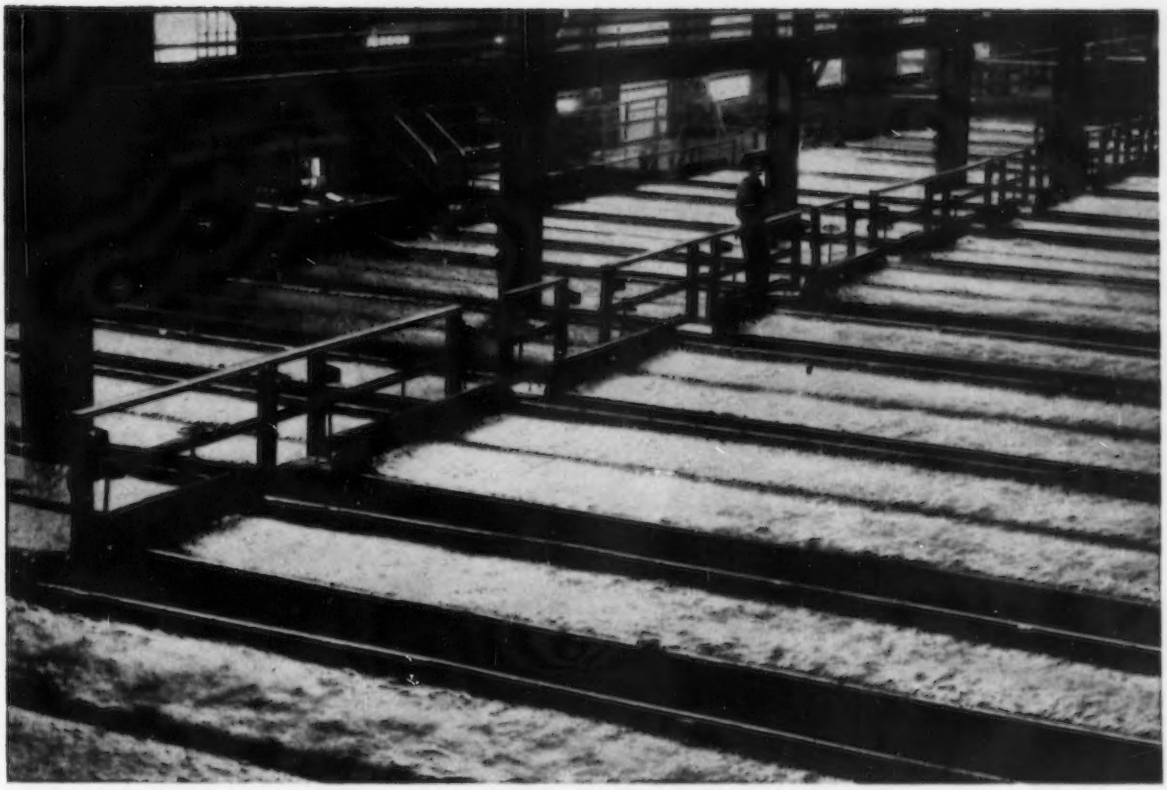
IN AUSTRALIA

Australian Atomic Energy Commission has disclosed that in the fiscal year ended June 30, a total of 73 discoveries of uranium were made in Australia. Queensland, with 41 discoveries, led the list ahead of New South Wales with 17 discoveries. Of these discoveries 28 will be followed up and 13 are still under investigation.

Western Uranium Mines N.L. is considering the establishment of a copper treatment plant at Ravensthorpe in Western Australia. Drilling and exploration work in the area proved successful and the proposed plant would produce copper concentrates on a throughput of 5,000 tons of ore each four weeks.

South Australian Government is to guarantee S. A. Barytes Ltd. the amount of $5-million for the erection of a treatment and milling plant at Quorn and for further development of the mine. The plant is expected to begin production early in 1957 and initial output is unlikely to exceed 10,000 tons per year. This, however, will rise later on to 15,000 tons.

Mt. Magnet Development N.L. reports that the crosscut on the 400-ft level in the footwall of the big lode of the Morning Star mine passed through a path of lode carrying high values between 21 and 31 ft. Some assays were as high as 68 dwt between 26 and 31 ft and check



Virtually all mining areas now standardize on Clarkson stainless steel units to accurately feed reagents to flotation cells. In 1939, Miami Copper Company, Miami, Arizona, was first of the Copper Concentrators to install stainless steel feeders. These early units still provide maintenance-free service for Miami Copper.

Stainless steel units good as new after 17 years of corrosive reagents

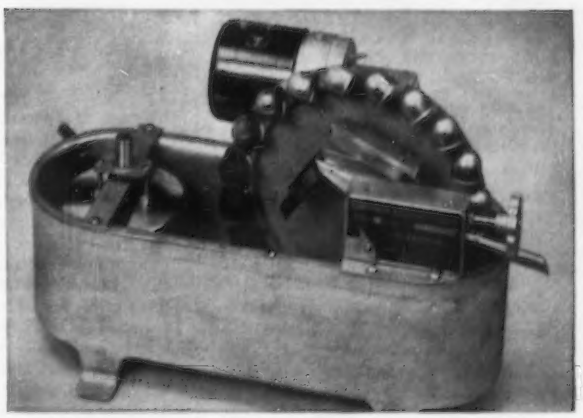
FLOTATION is an operation where the earning-power of stainless steel comes to the top.

Reagent feeders operating since 1939 still give good-as-new performance because they're made entirely of austenitic chromium-nickel stainless steel.

Regardless of where you operate, whether in non-metallic or metallic mining, there are hundreds of applications where chromium-nickel stainless steel will pay off handsomely.

As in feeders, stainless steel containing nickel lengthens equipment life. It resists attack by chemicals and atmospheres over a wide range of concentrations, pressures and temperatures. What's more, it is strong, tough, and ductile. Its high resistance to impact, wear and abrasion spells long, maintenance-free service under severest operating conditions.

There's no need to put off using stainless steels where you want long, money-saving performance. Leading steel companies produce austenitic chromium-nickel stainless steels in all commercial forms.



No replacements needed despite years of service under corrosive and abrasive conditions on units such as this. View shows interior of durable, corrosion-resistant 18-8 chromium-nickel stainless steel feeder, developed and produced by Clarkson Co., a Division of Equipment Engineers, Inc., San Francisco.

INCO TRADE MARK **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N.Y.

CHARCO LOW VOLTAGE GLOVES

REDUCE LOW VOLTAGE HAZARDS

LOW VOLTAGE GLOVE

LIGHT WEIGHT PROTECTOR

CHARCO'S electrically tested, special Low Voltage Glove is GUARANTEED to pass acceptance test of MORE THAN FOUR TIMES THE MAXIMUM WORKING VOLTAGE OF 600 VOLTS!

This light weight Low Voltage Glove is manufactured from the same pure rubber stock used in manufacture of all CHARCO Linemen's Gloves.

CHARCO'S Leather Protectors are tailor-made over a pattern form to fit this glove. To insure full flexibility, soft, thin leather is used

JOBBER INQUIRIES INVITED

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Manufacturers of RUBBER PROTECTIVE GLOVES AND SLEEVES FOR LINEMEN AND FOR USE IN INDUSTRIAL PLANTS

CHARLESTON RUBBER COMPANY

35 STARK INDUSTRIAL PARK

CHARLESTON, SOUTH CAROLINA

Australia *(Continued)*

samples from the east wall of the crosscut between 21 and 26 ft assayed 101.7 dwt. Crosscut has been advanced 60 ft to near where it is proposed to sink the main underlay winze to the 700 ft level.

Intensive prospecting is to be carried out over 1415 square miles on the western side of Cape York Peninsula in quest of bauxite. Australian Mining & Smelting Co., a subsidiary of Zinc Corp., has been granted the authority and is planning a three year exploration program.

Montana Silver Lead N.L. reports that an orebody over a 13 ft width has been revealed by assays of the recently recovered diamond drill core. Assays have discovered values of about 9.7% nickel and 4.0% copper. The area being prospected is at Zeehan, Tasmania and is 100 ft below the surface.

North Hercules N.L. has found ore assaying 19.6 dwt a ton in the drive on No. 3 shoot. The drive has been extended northwards and from 550-593 ft the average assay was 19.6 dwt over a width of 39 in. This shoot has now been exposed over a length of 140 ft.

An option on mineral beach sands was granted to Standard Ores and Alloys Corp. of New York, N. Y., by Rye Park Scheelite and Tungsten Consolidated Ltd. The U. S. company has begun check boring. Rye Park Scheelite N.L. has sold 75% of its proven rutile reserves on the Laurieton field to U. S. and European companies at fixed prices on a long-term delivery basis. Boring of the unproven areas is continuing.

Uranium Development & Prospecting N.L. reports high grade ore of about 1% uranium oxide in the No. 2 adit which has been advanced 30 ft to 110 ft. A four foot crosscut in the eastern wall of the adit has disclosed a strong pitchblende mineralization.

IN AFRICA

Messina (Transvaal) Development Co. is spending £4-million to make the Molly Mine, 20 miles from Sinoia, the biggest copper mine in Southern Rhodesia. When it comes into operation at the beginning of 1959 it will have an output of 2,000 tpd ore. The ore is comparatively low-grade though—only about one or two per cent compared with up to about 5% on the Copperbelt. The mine is expected to employ about 2,000 Africans and 200 Europeans. Molly Mine was recently acquired by the Messina (Transvaal) Development Company when it bought out Rhodesian Copper Ventures Ltd.

The company's Umkondo Mine, in the Fort Victoria district, has been in production only since the middle of last year, but already it has boosted the Colony's copper output from 41,353 tons in the whole of 1954 to 123,059 tons in the third quarter alone of last year. It is producing a steady 100-125 tons of refined copper a month. Ore from Umkondo is taken to the company's plant at Messina for refining. The Molly Mine, however, will have its own refinery.

Two Rhodesian copper companies have promised strong financial support for the rest Kariba hydro-electric power scheme in Central Africa.

Cost of the scheme has been estimated at more than $280-million. It will include a dam on the Zambesi river more than 365 ft high which will hold back a lake 200 miles long and 40 miles wide.

Anglo American Corp. and Rhodesian Selection Trusts have agreed to assist in the financing to the extent of $84-million.

The rival copper concerns will put up $56-million over a five-year period at cut-rate terms. In addition, they have agreed to pay $28-million "surcharge" on power supplied by Kariba to their companies from 1961 to 1967.

Annual Reports *(from p 73)*

Virginia Orange Free State Gold Mining Co. (46% Kennecott) reported that it had recovered 156,183 oz gold from 734,000 tons ore. Present capacity of cyanide mill will be raised from 75,000 to 125,000 tons per month by 1957. Uranium and pyrite recovery unit is in operation.

Merriespruit Gold Mining Co., Orange Free State, (46% owned) will be in commercial production early this year. Mill capacity of 75,000 tons will be increased to 100,000 tons per month. Uranium and pyrite units completed.

Total cost of rehabilitating Chase Brass plants at Waterbury after last year's floods was set at $11.9-million.

Kennecott's net income for 1955 was set at $125,516,000.

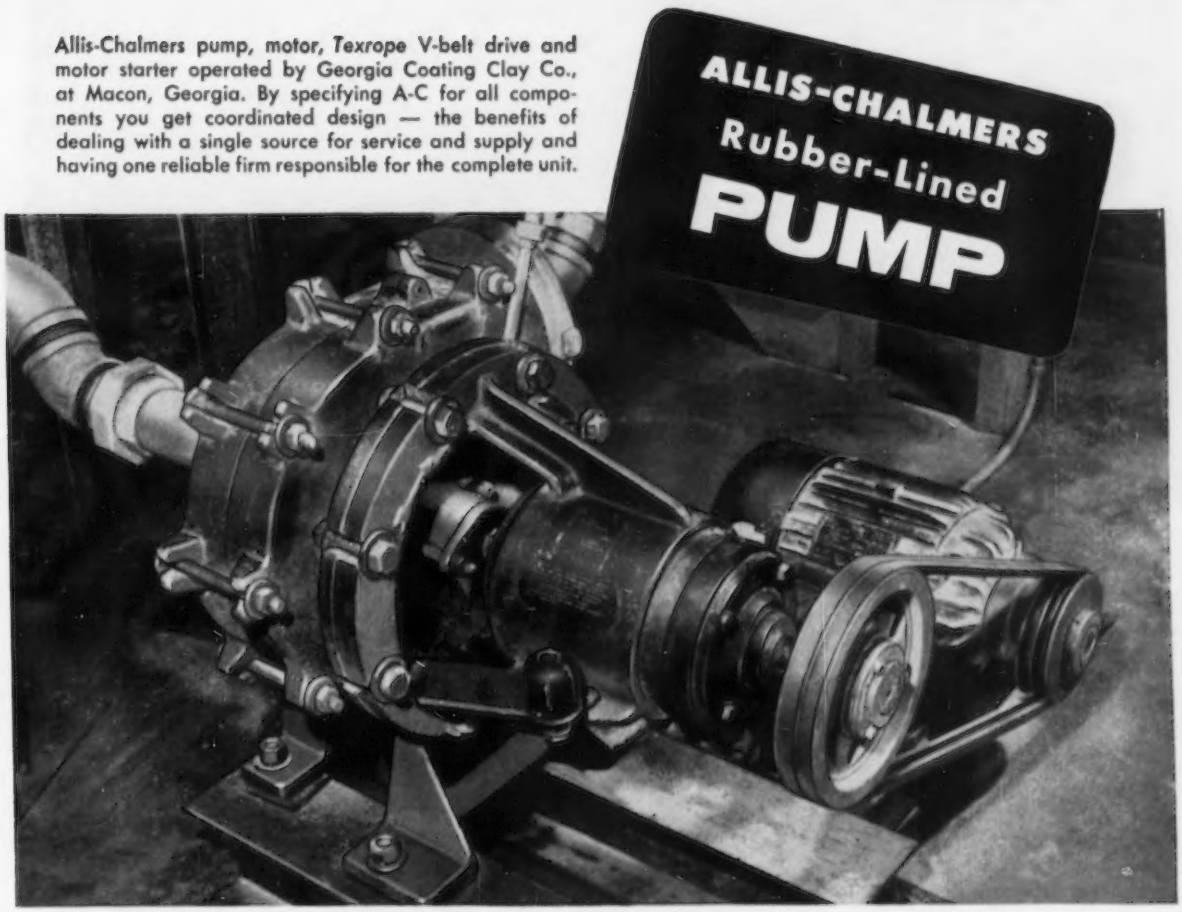
Newmont Mining Corp. net income for 1955 was set at $11,795,664. Following is a resume of companies in which Newmont has a stake: Idarado Mining (74.2% owned) mined and milled 267,250 tons. Mine and mill rehabilitation at adjoining property of Telluride Mines Inc. was completed with milling beginning in January. Operation at these two properties is expected to more than double Idarado's present output.

Newmont Mining Corp. of Canada continued explorations in that country. Societe Nord Africaine and Societe Algerienne du Zinc both increased production over previous year. Total output of these two properties was 172,756 tons lead and zinc ore. At El Abed shaft, substantial tonnage was added to reserves. O'okiep Copper Co. (56.3% owned) produced 29,428 tons blister.

Resurrection Mining Co., a cooperative venture between Newmont and AS&R, will develop mines of both companies now that the underground connection has been completed. Sherritt Gordon Mines, Ltd. had reserves of 13,820,000 tons, 1.15% Ni and 0.59% Cu at year end after milling 761,584 tons at Lynn Lake. Nickel refinery at Ft. Saskatchewan produced 16-million odd lb metal. Expansion to 20-million lb capacity is underway. Newmont will exercise convertability and receive 38.3% ownership.

Southern Peru Copper Co. in joint

Allis-Chalmers pump, motor, *Texrope* V-belt drive and motor starter operated by Georgia Coating Clay Co., at Macon, Georgia. By specifying A-C for all components you get coordinated design — the benefits of dealing with a single source for service and supply and having one reliable firm responsible for the complete unit.



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Marion Dipper, showing front and teeth of Tisco Manganese Steel

Marion Power Shovel treads of Tisco Manganese Steel

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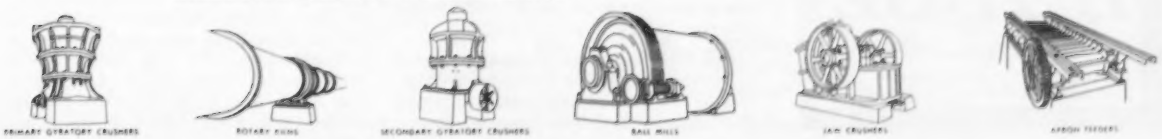

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Annual Reports *(Continued)*

venture with Cerro de Pasco Corp. transferred Moquegua deposit to SPC, which also acquired Toquepala and Quellaveco copper properties from AS&R. Reserves are 1-billion tons, 1% Cu. Mill will have 30,000 tpd capacity. Project includes a smelter.

Tsumeb Corp. Ltd. (28.5% Newmont) reported mill output at 106,908 tons saleable metal, including Cu, Pb, Zn, plus 1,216 tons germanium concentrate. Exploration and research problems called for the expenditure of $776,545 at Newmont enterprises during the year. Newmont Exploration Ltd. will build a combined geophysical and metallurigcal research plant at Danbury, Conn.

Cassair Asbestos Corp., Ltd. (17.1% owned). Newmont purchased an interest in this newly developed high grade, long fiber, 500 tpd mill. Dawn Mining Co. (51% owned). Appreciable reserves of commercial grade uranium ore are on hand, but must await contract with AEC. At present there is no processing mill near at hand.

Empire Mines Co., Ltd. treated 33,942 tons gold ore and recovered $45.06 per ton feed. New Verde Mines took option on an uranium prospect. Granduc Mines Ltd. (34.6% Newmont) had reserves of 25.6-million tons, 1.62% Cu. Further drilling is planned. Shaft will be sunk to 1200 ft for underground development.

Magma Copper Co. (21.5% owned) produced its first pound of copper at San Manuel in January. Full production at 70,000 tons blister per year should be reached by mid-year. Turk Madencilik Anonim Sirkete carried out exploration work in Turkey, but no significant deposits were found. Winkelhaak Mines Ltd. reported large reserves of reef gold at their South African concession.

Howe Sound Co. cobalt refinery at Garfield, Utah was turned over to the company by Chemico late in December 1955. While all the problems in the process are not yet solved, progress is being made. Properties at Blackbird, Britannia, Snow Lake, El Potosi, El Carmen and Chelan Division all reported normal or near normal operations.

La Luz Mines Ltd. milled 701,300 tons ore and recovered 67,913 oz gold. Cost per ton milled was $2.70 and profit per ton was $0.67. Reserves were 6,245,000 tons, 0.114 oz gold. At Rosita Mines Ltd., company reported ore reserves at 3,782,000 tons of high grade copper. Roast-leach process has been developed in the laboratory to handle this mixed oxide-sulphide ore.

Natomas Co. reported a net income of $82,164 for the fiscal year ending September 30, 1955. Cubic yards dredged were 22,431,152. Net returns were down from 1954. South Platte Dredging Co. remained idle during year.

Tanganyika Concessions Ltd. showed a net profit after taxes of £3,000,830 for the year ending July 31, 1955.

Union Minere du Haut Katanga reported a profit of Congolese francs 4,904,331,396 for the year ending 1954. One pound Sterling is equal to 140 Congolese francs.

North Broken Hill Ltd. showed net profit after taxes of A£2,011,095 for the year ending June 30, 1955. During the year 383,254 tons were mined and 382,217 tons milled. Recovery was 70,465 tons lead concentrate averaging 71.3% Pb and 72,920 tons zinc concentrate averaging 51% Zn. A£310,668 was spent for new plant and mine development. Reserves were set at 4,697,000 tons. Block 14 reserves were depleted.

Haile Mines, Inc. and subsidiary companies had a net income after taxes of $3,791,455. Tungsten Mining Corp. and Manganese Inc. provided the bulk of this return.

West Coast Mines treated 181,272 tons ore and obtained 52,012 tons zinc concentrate, 8,123 tons lead concentrate and 6,711 tons copper conc. Ore reserves remained at the 2-million ton mark.

Consolidated Gold Fields of South Africa Ltd. net profit for the year ending June 30, 1955 was £948,000, after taxes. Gold mines recovered 2,905,000 oz gold from 10,700,000 tons ore. Four new mines were started. Company holds interest in Buell Engineering Co., Tri-State Zinc and Yukon Consolidated Gold Corp., as well as many mines in South Africa, Australia and Trinidad.

Wattle Gully Gold Mines, N. L. stated that ore reserves as of June 30, 1955 were 100,000 tons, 7 dwt ore. Operating cost was 97.04s per ton. Net profit was A£42,304 from the 10,246 oz gold recovered.

North Broken Hill Ltd. estimated reserves at 4,697,000 tons after extracting 383,254 tons. Ore milled averaged 13.5% Pb, 11.2% Zn and 7.2 oz silver. Profit for year ending June 30 was A£2,011,095.

Mount Morgan Ltd. milled only 930,500 tons, although they mined over 3-million tons. Smelter produced 6,765 tons blister, 67,815 oz gold and 21,185 oz silver. Cost of mining and milling was 36/8.24 per ton. Smelter cost was A£64 18s 2d per ton concentrate. Ore reserves were 16,300,000 tons averaging 1.01% Cu, 15% S and 12.61 dwt gold.

Broken Hill South Ltd. estimated ore reserves at 1,650,000 tons. They mined and milled 264,215 tons at a net profit of A£1,702,118. Lead, zinc concentrates were produced, along with the silver.

Morning Star Mines, N. L. Milled 16,909 tons ore and recovered 10,087 oz gold. Reserves were estimated at 32,000 tons, 10.5 dwt gold. Mining costs were 88.6s, milling 40.8s, development and drilling 17.2s for a total cost of 146.6s per ton.

Golden Plateau, N. L. mined and treated 28,016 tons at a cost of A£4 5s 6d per ton. Mill recovered 14,872 oz gold and 9,207 oz silver. Reserves estimated at 82,300 tons.

Mineral Exploration Corp., Ltd. continued prospecting and development work at Cape Breton Concession. Results to date at Meat Cove show probable ore at 2,750,000 tons, 2.5% zinc. Rocky Brook strike is still being drilled. Laboratory tests show that Meat Cove ore can be treated with 85% zinc recovery. Con-

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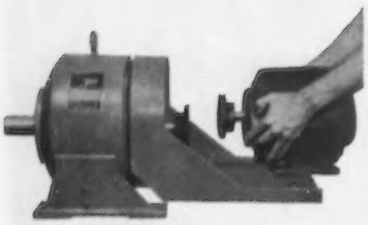

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Annual Reports *(Continued)*

struction work was undertaken on the surface plant and mill.

Steep Rock Iron Mines Ltd. reduced operating costs by 10% of 1954 figure and showed a profit of $9,240,000 after taxes. Iron ore shipped amounted to 2,265,555 tons high grade iron ore. Errington No. 1 underground mine will go into production in 1956. First ore from Errington No. 2 is expected by 1959. Both mines will employ block caving. By 1959 Steep Rock will produce 5.5-million tons per year. Ore reserves at Steep Rock Range are almost 300-million tons per 1,000 ft depth of ore. Deepest hole drilled was in ore at 2100 ft, with more expected below.

Inland Steel Co. produced 1,438,904 tons iron ore in 1955. This was an increase over 1954, despite the flooding of Sherwood mine at Iron River, Mich. Development work at Armour No. 2 began with the new shaft sinking. In 1956 Inland will join several other mining companies, including Cleveland-Cliffs Iron Co., in the formation of Marquette Iron Mining Co. This subsidiary will mine the low grade ore at Republic and Empire on Marquette Range.

Ore at Marquette will be pelletized and sintered at new plant at Negaunee. First shipment is scheduled for 1956.

Mount Lyell Mining & Railway Co. resumed dividend payment after an eleven year lapse, showed a profit of A£808,231 for the year ending Sept. 30. Operating on lower grade ore, 47,000 tons were mined and produced 8,750 tons copper concentrate. A new adit was driven to a new ore bench. 1956 production will come from this new bench, but production during this coming season will be less than 1955. The mill functioned smoothly. Diamond drilling continued on several new prospects.

Johns-Mansville Corp. pointed out in their annual report that net earnings were $23.5-million, second highest in company history. Company reported progress in the expansion and development at its three mines and 22 plants in Canada and the U. S. company produced 592,000 tons asbestos fiber. New mill at Jeffrey mines, Canada will be completed this year. Expansion of underground operations at Jeffrey and Munro was continued. In February, J-M signed an option on a large gypsum deposit in Nevada and is considering going into gypsum market.

Freeport Sulphur Co. reported net income at $12,401,058. Oil reserves were set at 50-million barrels and gas reserves at 200-billion cu ft. Sulphur production was in excess of 2-million tons. Hoskins Mound mine was exhausted. New mine went into production at Chacahoula, La. Large deposit noted at Lake Pelto, La.

In the nickel market, a pilot plant to process Cuban nickel was completed near New Orleans. Commercial facilities will follow a successful pilot operation. National Potash Co., owned by Freeport and Pittsburgh Consolidated Coal Co., will have the Carlsbad, N. M. potash deposit in production by 1957.

Magma Copper Co. produced first copper from San Manuel deposit in January. At Far East Area, a new drifting and crosscutting program revealed additional high grade ore. Deepining of No. 6 shaft to 2550 ft was started. Total production from this area was 143,914 tons, 5.1% Cu. In Koerner Vein production was 113,850 tons, 6.6% Cu. Main Vein development continued to show lots of new 6% Cu reserves.

Great Northern Iron Ore Properties reported that 8,358,843 tons iron ore were shipped from its mines during 1955.

Siskon Corp. had to shut down mill at Siskon, Calif. due to December rains. Operations resumed March. Gold-silver bullion recovery at Siskon was reported at 91% yield and amounted to $798,289. Ore reserves were satisfactory and justified increase in milling capacty to 250-300 tpd. Siskon acquired option on Reliable Copper mine and 100-ton mill near San Manuel. Leaching in place will be considered. Estimated 42-million lb copper present. Leaching is expected to yield 50% of the reserves.

Texas Gulf Sulphur Co. produced 9% more sulphur in 1955 than in previous year. Over $3-million was expended at the Frasch plant in Mexico, where production will begin this year. Construction of Frasch plant at Farrett, Texas was also started.

Westinghouse Electric Corp. net income after taxes and the long strike period was $42,803,000, down 46% from 1954. Cost to the employees due to the strike was over $80-million in wages for the year. Westinghouse will bet 20-million on the atomic field.

Colorado Fuel & Iron Corp. plans to spend $23-million in fiscal year ending June 1956 to modernize and enlarge Buffalo and Pueblo steel mills. Buffalo ingot capacity has been increased to 120,000 tons per year. Pueblo mill capacity will be expanded to 200,000 tons ingot per year.

Macassa Mines Ltd. treated 142,860 tons and recovered a net profit of $579,461 for the year. Additional gold reserves were developed. Operating costs were low enough that the company did not need assistance from the Canadian Government's Gold Assistance Act.

Renable Mines Ltd. treated 165,656 tons during the year. Net profit was $251,583. Installation of cyanide flowsheet was completed.

Bicroft Uranium Mines Ltd. has contract with Eldorado to deliver $35,805,000 worth of uranium concentrate. Mine and mill will be completed this fall.

United Park City Mines Co. reported that ore reserves were increased during the year. Net income before depletion was $267,949. Some 79,363 tons were mined from properties at Park City.

Homestake Mining Co. milled 1,550,116 tons ore, but the value of bullion was down from 1954 figure by $345,000, despite increased tonnage milled and higher recovery. Grade of ore was down. Reserves were 16,689,000 tons. La Sal and Little Beaver uranium properties

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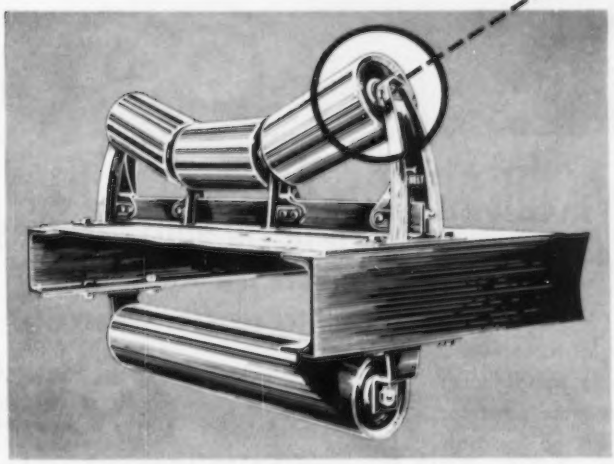

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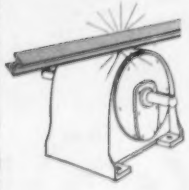

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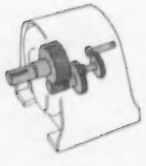

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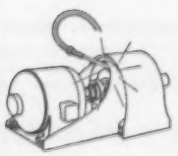

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59 Years of Experience

BRUNTON*
pocket transit

for
mining engineers

- Ideal for preliminary and supplementary surveying
- May be used as compass, transit, level, plumb, alidade, clinometer
- Small, lightweight, only 9 oz., 2⅝"x3"x 1⅛"...easy to carry in pocket, on belt.
- Shows direction to 1°...level, slope or grade within 1°.
- Used in hand or on tripod.
- *Made to last a lifetime.*

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2151 Lawrence Street Denver 2, Colorado
Over 50,000 Brunton Transits since 1896
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Annual Reports *(Continued)*

were brought into production. Activity next summer will center around new showing at New Haven, Wyo. Some 4800 tons 0.24% uranium ore were shipped from New Haven last year.

Minerals Engineering Co. reported an income of $918,424 for the year. New crushing plant and additions to the mill at Glen, Montana cost $557,300. Company mines tungsten.

Standard Uranium Corp. reached full production capacity during the year, managed to ship 96,440 tons uranium ore. Averaging 450 tpd, the mine operated at a cost of $7.3 per ton ore. Profit before depletion was $1,064,515. Claims 9 and 9a have two more years ore supply at present rate. Mamie claim has 109,296 tons ore blocked out to date.

Aunor Golf Mines Ltd. reported an increase in grade of gold ore and total reserves. Net profit was $404,779.

Sodak Uranium & Mining Co., Inc. reported that Busfield claim has been on 1,000 tons per month schedule and will go to 1,500 or 1,000 tons per month this spring. Reserves are 20,000 tons. Phillips claim is being mined at approximately 700 tons per month; 2,000 tons reserves. Company acquired 3,500 acres at Hawthorne ranch, South Dakota and Wyoming and 10,000 acres in Converse County, Wyo. Net operating loss covering last 14 months is $139,814.

American Potash & Chemical Corp. completed the San Antonio lithium hydroxide plant and expanded production at Bikita Minerals, Southern Rhodesia. Searles Lake produced 762,310 tons products, including borax, salts and lithium compounds. Net income for entire operations was highest in company history: $4,060,192.

Chief Consolidated Mining Co. has abandoned part of Chief No. 1 mine due to water problems. Plutus Mining Co. subsidiary is operating at 500 tons per month, 24.6 oz silver. Drilling continues to be favorable at Bear Creek. During the year the company entered into agreement with Tintic Standard Mining Co. to explore joint properties. Exploration cost will be several million dollars.

M. A. Hanna Co. showed a net profit of $15,602,703. More than 14-million tons ore were produced from company iron mines in the U. S. and 8.5-million from Quebec-Labrador deposit. Iron Ore Co. of Canada project will have 10-million ton per year capacity when completed this year. Hanna finished construction of Riddle, Ore. nickel refinery and had it at 50% capacity most of the year, producing some 6.5-million lb ferronickel.

Hudson Bay Mining & Smelting Co. ore reserves at year end were 16,516,000 tons, 3.15% copper plus zinc, silver and gold at Flin Flon and 728,000 tons have been developed at Kluane Lake property. Kluane Lake runs 2.05% nickel and 1.42% copper. Net profit for year was $20,740,675. Flin Flon yielded 93-million lb copper; plus considerable zinc, gold and silver.

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FLOTATION

FOR BETTER ECONOMY USE THE MACHINE THAT LOWERS COSTS

COMPLETELY EQUIPPED LABORATORY FOR TESTING ORES TO DETERMINE THE BEST METHODS OF TREATMENT. 40 YEARS EXPERIENCE AVAILABLE TO YOU

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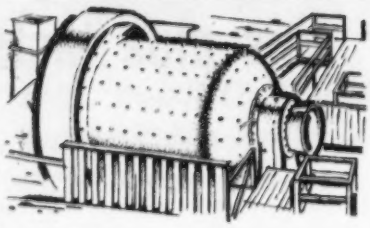
MANUFACTURE • EQUIPMENT



slurries flow easier
with PQ Sodium Silicate

Prior to flotation in wet grinding add PQ sodium silicate to condition mineral surfaces and improve separation. Also, pumping is easier.

- *Describe your operation and let us send you test sample of the right sodium silicate.*

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Stemming material delivered by 2¼-yd. Michigan 175A

Commutes 2 miles between Arizona pits . . .

Versatile Michigan pays for itself on a multitude of open pit jobs

This 2¼-yd. Michigan Tractor Shovel works at one of the biggest open pit copper mines in Arizona. At this location two pits are being mined: one a 4000 x 6000 pit up to 600-ft. deep; the other a new cut two miles away. Between these pits, the 27-mph Michigan commutes on its own power to handle a multitude of jobs.

Cleans up excess ore

Prior to blasting, the Michigan cleans up excess ore around the toes of the benches. It takes less than two minutes to put a heaping load into a 6-yd. dump truck. This efficient clean-up job makes for fuller breakout of material when blasting.

Delivers stemming material

No matter how hard the drillers try to dispose of the mud from the churn-type blast hole drills, trucks are often unable to get through to deliver stemming material. The 4-wheel drive Michigan easily works through the mud, delivers loads of stemming material to the powder loading points to keep shots on schedule.

Cleans up around shovels

When the crawler bulldozers come off the mine floor for repairs, the 133-hp Michigan does the clean-up work around the power shovels. Working on a new addition to the concentrating plant, the Michigan handles sand, aggregate and cement at the concrete plant. The Michigan also built a baseball diamond and part of an air strip by hauling and spreading the necessary material. Its big rubber tires even did the compacting!

A versatile work horse

With Clark torque converter, power-shift transmission and planetary-wheel axles, the Michigan Tractor Shovel delivers *more useable power and traction than you've ever seen on this type of machine.* It will handle amazingly heavy jobs—in addition to the routine assignments which affect the performance of the more expensive equipment, like power shovels, drills and rolling stock. For proof that the Michigan is in a class by itself, ask for an on-the-job demonstration. *You name the job.*

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2465 Pipestone Road
Benton Harbor 23, Michigan

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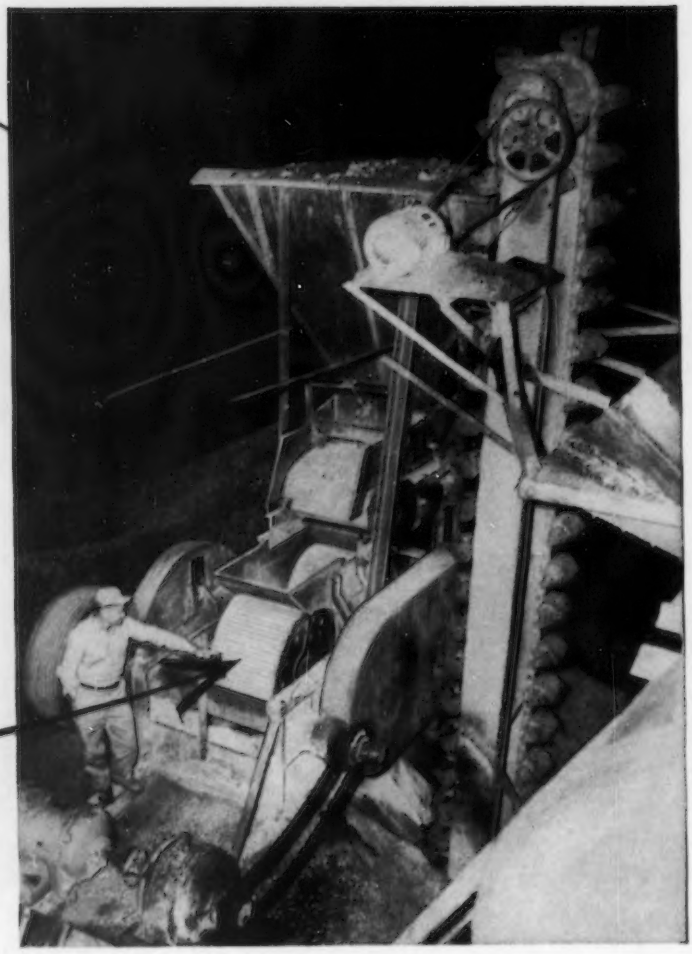
CLARK® EQUIPMENT

Crushing Life Increased 500% by Hard-Facing with HAYNES 90 rod



Hard-facing the rolls in this crusher rig with HAYNES 90 Rod makes them more than 5 times more durable. Two sets of rolls are used to crush rock from 3-in. down to ½-in. screen size. They handle up to 26 thousand tons of rock with a minimum of repairs—despite severe wear from abrasion and impact. Other hard-facing materials wore out before 5,000 tons of rock were crushed.

Since HAYNES 90 Rod was adopted as the standard material on this job, production increased, down-time was reduced, labor and maintenance costs were cut, and less hard-facing material was needed per ton of rock crushed. This is typical of the kind of savings that can be realized by hard-facing with HAYNES alloys.

HAYNES hard-facing alloys give outstanding service when used to protect parts in crushers, shovels, tractors, trucks, conveyors, and other metal parts exposed to wear from abrasion, impact, corrosion, or heat.

Your local dealer carries a complete line of HAYNES hard-facing alloys, including: HAYNES iron and nickel-base rods, HAYNES STELLITE cobalt-base rods, and HAYSTELLITE tungsten carbide tube rods. Ask him for descriptive literature. If you don't know the location of your local dealer, write to Haynes Stellite Company, a Division of Union Carbide and Carbon Corporation, Kokomo, Indiana.

See... Your local Haynes Stellite Dealer

or

Write... to Haynes Stellite Company

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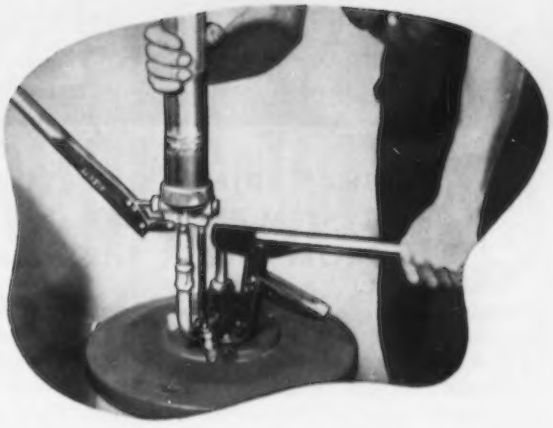
YOUR PRODUCTION GOES UP...

when you switch lubrication methods from

Backward to Forward!



ALEMITE HAND GUN WITH LOADER PUMP

reduces downtime...cuts man-hours

...saves right down the line!

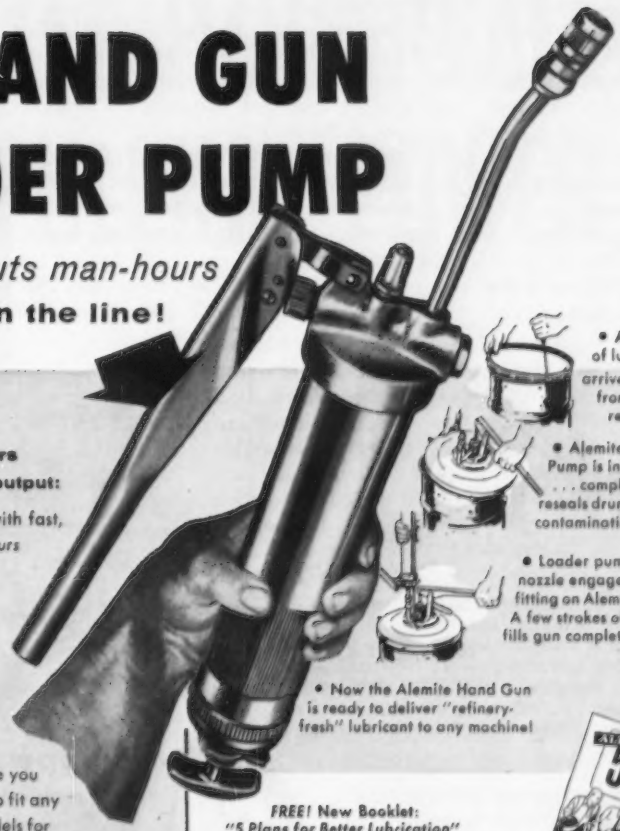
Why more and more plant managers look to Alemite lubrication for greater output:

Time studies prove it! Refilling hand grease guns with fast, efficient Alemite Loader Pumps saves you *15 man-hours* for every 400-pound drum of lubricant, compared with loading the old-fashioned hand-and-paddle way!

You eliminate the cost, mess and fire hazard of "oil-room" spillage. With Alemite equipment you can *transfer, load and apply* lubricant that you know is *completely* free of dirt, grit or abrasives. Machine-hours are saved, too! With better lubricated bearings, machines stay new longer!

Alemite can furnish a hand gun of correct capacity for your operation—from 8 ounces to 2 pounds. And you get the pressure you need—up to 15,000 pounds! There is an Alemite Loader Pump to fit any standard lubricant container you normally use—stationary models for 100-lb. and 400-lb. drums; portable models for 25-lb. and 35-lb. pails.

Ask your nearest Alemite supplier for full details.



- A drum of lubricant arrives—fresh from the refinery.
- Alemite Loader Pump is inserted . . . completely reseals drum against contamination.
- Loader pump nozzle engages fitting on Alemite gun. A few strokes of pump fills gun completely.
- Now the Alemite Hand Gun is ready to deliver "refinery-fresh" lubricant to any machine!

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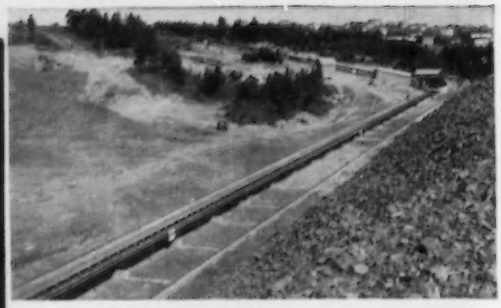


Trans-island **STEPHENS-ADAMSON** belt conveyor carries iron ore from processing station to storage area. Belt in foreground is 736' long and feeds the stacker belt (rear) which is 915' long.

S-A SUBMARINE CONVEYOR SYSTEM RECOVERS ORE FROM UNDER THE ATLANTIC

Deep under the ocean floor—more than two miles out under the rolling Atlantic, great ore tonnages are being removed, by S-A equipment, from one of the earth's most fabulous iron deposits. This iron treasure chest is the Dominion Wabana Ore Limited mine owned by the Dominion Steel and Coal Corporation, Limited at Bell Island, Newfoundland.

No less spectacular than Wabana itself is the performance of the completely engineered and installed STEPHENS-ADAMSON conveying system which steadily processes and pours tremendous ore tonnages from the depths into above ground storage. This system includes the longest underground slope belt conveyor in the world.

But most impressive at Wabana is the story of STEPHENS-ADAMSON operational economy. This installation of modern material handling equipment has enabled this Company to increase production and reduce operating costs. The result is a more commercially available ore.

Wabana is a working example of why it pays to convey the S-A way.

This view shows S-A conveyor belt leading from deck head in the background to traveling tripper which distributes ore over surge pile.

A 125 ft. stacker boom conveyor is delivering ore to shipping pocket. Belt travels 595 F.P.M.—delivers 1250 T.P.H. Boom elevates to 18° and swings horizontally thru 180°.

Diagram drawing of S-A conveyor system at Wabana. Underground belt conveyor is 2¼ miles long, lifts ore a total of 1670 feet and delivers 1050 tons per hour. Belts travel at 575 feet per minute on heavy duty Simplex carriers. Underground crushers and feeders supply the belt.

STEPHENS-ADAMSON can completely engineer, build and install your conveying system. Our engineers are also available to work with mining engineers, consultant firms, and plant engineers.

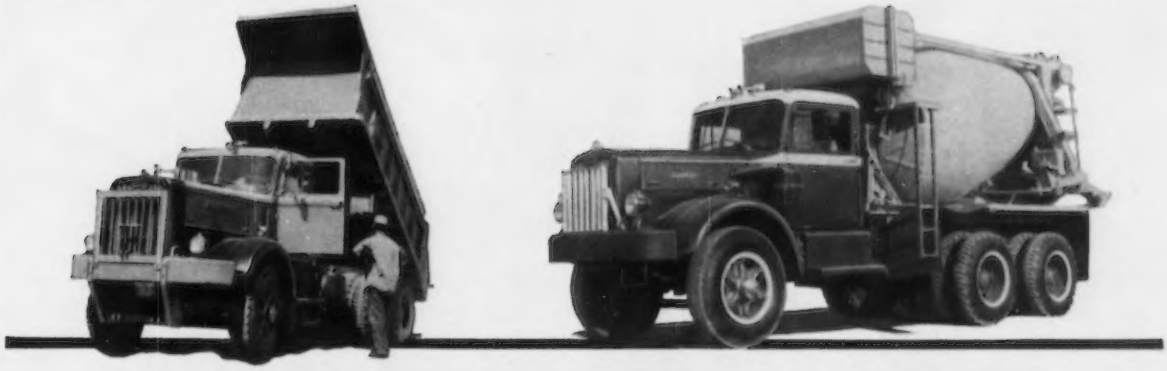
STEPHENS-ADAMSON MFG. CO.

4 Ridgeway Ave., Aurora, Ill.—Los Angeles, Calif.—Belleville, Ontario.

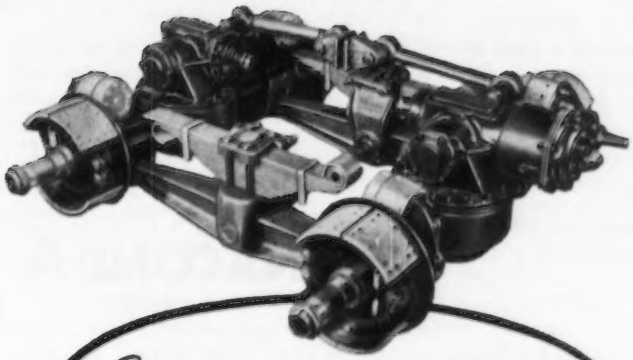
ENGINEERING DIVISION
Designers and manufacturers of all types of bulk materials conveying systems.

STANDARD PRODUCTS DIVISION
A complete line of conveyor accessories—centrifugal loaders—car pullers—bin level controls, etc.

SEALMASTER DIVISION
A full line of industrial ball bearing units available in both standard and special housings.



AUTOCAR TRUCKS WITH GREAT, NEW 44,000 LB. TANDEM AXLE HAVE REALLY RUGGED PULLING POWER



BIGGER and huskier than ever—these new "All-American" Autocars for both on and off highway work. This heavy-duty tandem with 44,000 lb. rating has rugged power and stamina. Positive traction, too, with driver-controlled power lockout that makes rough and tough going easy. Plus Autocar nut and bolt construction!

Send for your copy of the New **AUTOCAR** *Construction Folder... NOW!*

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AUTOCAR TRUCKS
DIVISION OF THE WHITE MOTOR COMPANY, EXTON, PA.

CABLE AND MINE EXPERIENCE enable Anaconda to design and build shovel cable that resists razor-sharp rocks, water, sun, heat, cold, and — most important — run-overs.

This cable was "built" in our mines to perform better in yours

If you were a cable manufacturer as well as a miner, you could use your mine experience to build cable better than others.

But since you aren't, it will pay you to buy your cable from Anaconda—who *is* both cable manufacturer *and miner.*

FOR SHOVEL CABLE

Years of mine experience . . . of cable testing and improving . . . have taught us how to make a cable that *stays on the job longer under all conditions.* It's Securityflex* Type SH-D cable.

New, job-tested, high-grade butyl insulation assures better resistance to heat, water and compression. And new neoprene jacket makes this cable even tougher and more abrasion-resistant.

For Type SH-D, *or other shovel cable,* let Anaconda mine and cable experience pay off for you. See your Anaconda Distributor. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 56321

*Trade Mark

ANACONDA®
MINE CABLE

FLAT-TWIN CABLE

Improved stranding, new insulation, new grounding wire, and neoprene jacket make this a superior cable for shuttle cars, continuous miners, loaders, drill trucks, cutters.

POWER CABLES

AnacondA Types W & G are rugged, sturdy and long-lived. Used for mine power, shovels, continuous miners, loaders, drill trucks, cutters.

SHOVEL AND DRILL CABLES

Securityflex* Types W and G are used with small shovels, self-propelled drill trucks, pumps and a-c mining equipment. For higher voltages, Type SH cables (shielded) are recommended.

SECURITYFLEX CORDS

Unexcelled for strength, wear resistance and long life. Type SO (heavy-duty) provides superior service on remote control and hand drills.

- TROLLEY WIRE
- FEEDER CABLE BARE OR INSULATED
- TELEPHONE WIRE
- SHOT-FIRE CORD
- WELDING CABLE

Two International TD-24-TC Crawler Tractors paving the way for new mountain road at Camp Pendleton, Calif. TD-24 offers International Torque Converter Drive as optional equipment, standardizing on Twin Disc Torque Converter Components.

6 profitable reasons why you need a *torque converter* in your crawler tractors

For higher work output . . . and *longer equipment life,* more and more contractors are ordering International TD-24 Torque Converter Crawler Tractors.

Torque converter drive offers *six profitable, proved* advantages applicable to *your* crawler tractors. 1. Three-stage design provides the highest engine output torque multiplication available — eliminating harmful, costly engine lugging and stalling. 2. Engines work up in the maximum efficiency range *all* the time, delivering *constant* high-horsepower output . . . doing *more work* than units equipped with mechanical drive. 3. Power is *automatically* matched to load demands, with gear-shifting minimized or eliminated — where mechanical transmissions must *stay* in the starting gear ratio, even after starting load resistance is reduced . . . operator efficiency is boosted. 4. Heavy load pick-up is smooth, even, without clutch slippage . . . better flotation is obtained. 5. Overloads, shock loads and vibrations are cushioned *out,* through *fluid* connection . . . providing longer tractor life with less maintenance. 6. Infinite variety of ratios are available to work with, permitting smooth, accurate control of loads and delicate "inching" under power.

Wherever earth and rock are moved, owners are using these six basic advantages *to convert their horsepower into more profits.* That's why International Harvester designed torque converter drive into the TD-24. They worked closely with Twin Disc Engineers, and have standardized on Twin Disc Torque Converter components.

Be sure there's a torque converter in *your* next TD-24! See your International Industrial Power Distributor, *today,* for information.

TWIN DISC

TWIN DISC

Torque Converters

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division) Rockford, Illinois

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IN TUNNELS AND MINE SHAFTS

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We are interested in getting into contact with firms who can introduce our tubing on your market. Please approach us if you think the matter of interest.

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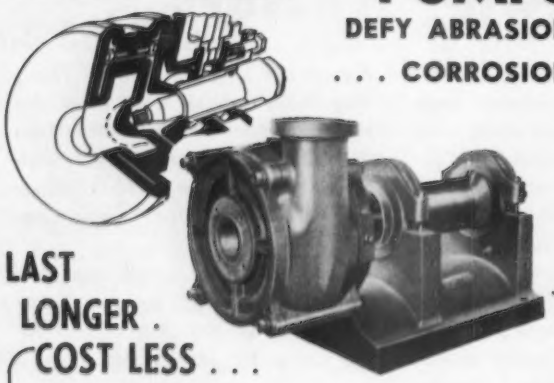
LINATEX SAND PUMPS
DEFY ABRASION . . . CORROSION



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If you are responsible for an efficient pumping operation at your plant, write for further information on the LINATEX Pump.
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How the 4-Wheel-Drive 'Jeep' family does more jobs better...faster!

Mobile Power. This 4-Wheel-Drive Universal 'Jeep' takes a mobile welder to out-of-the-way locations. With power take-off, the 'Jeep' also operates compressors, generators, drills and winches.

Transportation. The 4-Wheel-Drive 'Jeep' Truck transports men, tools and equipment between mines or wherever they're needed. Keeps maintenance service and supplies moving smoothly.

'Jeep' 4-Wheel-Drive vehicles are proving their value and versatility every day in every phase of the mining industry. From exploring or prospecting in remote areas to keeping maintenance work and service moving smoothly, they demonstrate their versatility. With the extra traction of their 4-wheel drive, they haul ore trailers in trackless mining — up steep inclines, or over rocky ledges. And for travel on good roads they shift easily into 2-wheel drive. Versatile 4-Wheel-Drive 'Jeep' vehicles pay for themselves in a short time because of their adaptability to many jobs, economical performance, long life and low maintenance costs. See your 'Jeep' dealer or write for information.

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For either core drilling or any other type of diamond drilling, we believe these to be the most efficient and economical diamond bits ever produced and invite inquiries on that basis. Available at no advance in price in a wide variety of types and sizes to meet every diamond drilling requirement. Bulletin No. 320 illustrates all types and gives complete working data. Write for free copy and tell us about your drilling conditions. We welcome opportunities to make money-saving recommendations.

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MODEL 30 and MODEL L-2

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Model 30 Trailer Mounted

For easy portability without tying up a truck. Also complete truck-mounted units with 4-wheel drive.

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STOCKED FOR PROMPT SHIPMENT

We manufacture a wide variety of accessory equipment for diamond drilling and soil sampling and carry all essential items in stock for prompt delivery. A NEW CATALOG, No. 400, not only illustrates and describes each item but also gives piece numbers and shipping weights. Write to day for a free copy; it will help you to save time and money.

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For more than seventy years, Sprague & Henwood, Inc. has been a leader in the field of Contract Diamond Drilling and Soil Sampling. During this long period of time our crews have completed thousands of contracts successfully, under every conceivable operating condition. Today, we have a large force of expert operators and an ample supply of modern equipment, so that we can undertake practically any job anywhere, on short notice. Inquiries for all types of contract drilling work are solicited — estimates submitted promptly without charge or obligation.

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Saves high transportation and treatment charges on your ores and concentrates.

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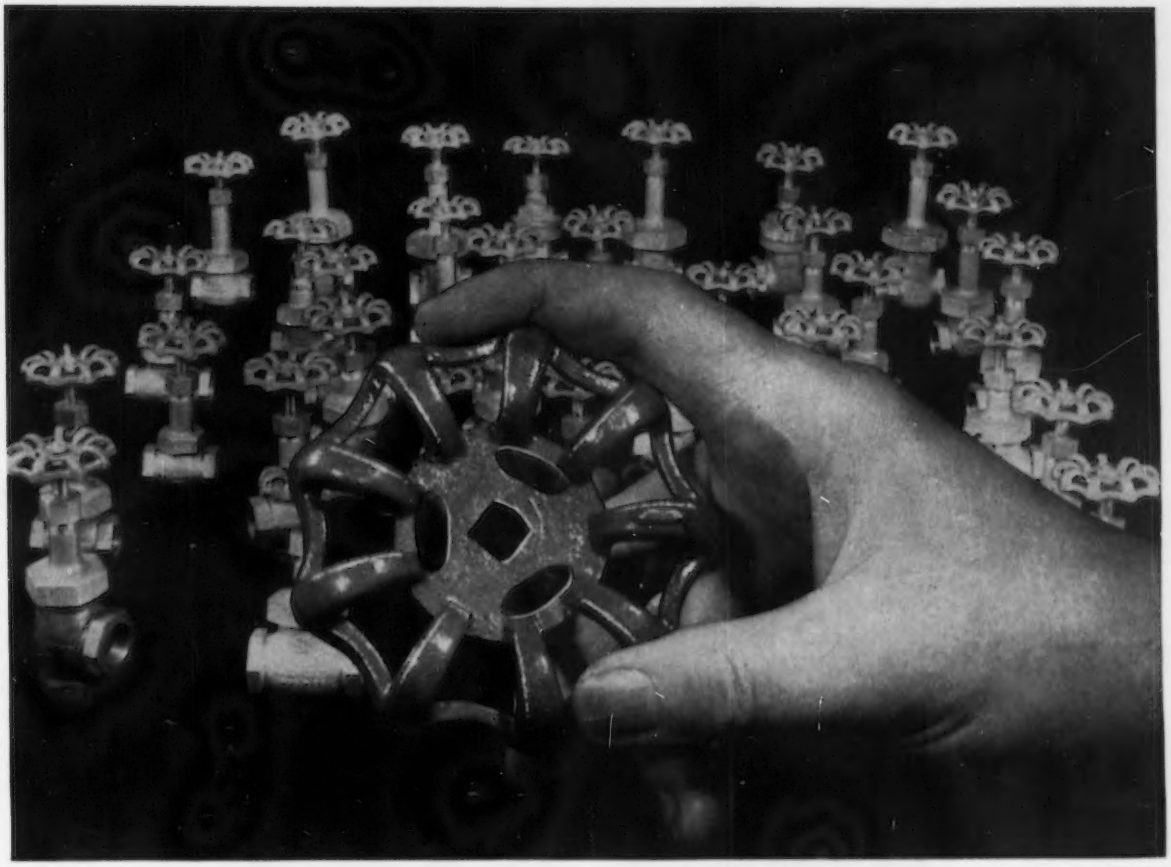

One handwheel fits 39* different valves

*Walworth Handwheel No. 16 fits these Walworth Bronze Valves:	
¾"	No. 32, 40, 47, 48, 205, 206, 225P, 227P, 260, 261, 260P, 261P
1"	No. 29, 30, 36, 37, 91, OX91, 92, 95, 96, 160, 161, 235, 236, 245, 246, 245P, 246P, 237P, 238P
1¼"	No. 58, 59
1½"	No. 2, 3, 4, 11, 12, 14

Only Walworth Bronze Valves give you this degree of interchangeability

With standardized Walworth Bronze Valve parts you maintain the greatest number of valves with the smallest inventory of basic parts. Handwheels are just one example. Fourteen different sizes of handwheels are all you need for fifty lines of gate, globe, and angle valves, involving 420 individual valves.

The Walworth system of interchangeability of parts for Bronze Valves is unsurpassed by any manufacturer in the field. In addition to Bronze Valves, Walworth produces valves and pipe fittings of iron, steel, special alloys, and rigid polyvinyl chloride (PVC).

Learn more about Walworth interchangeability. Contact your local Walworth Distributor or nearby Walworth Sales Office. Ask for literature.

WALWORTH

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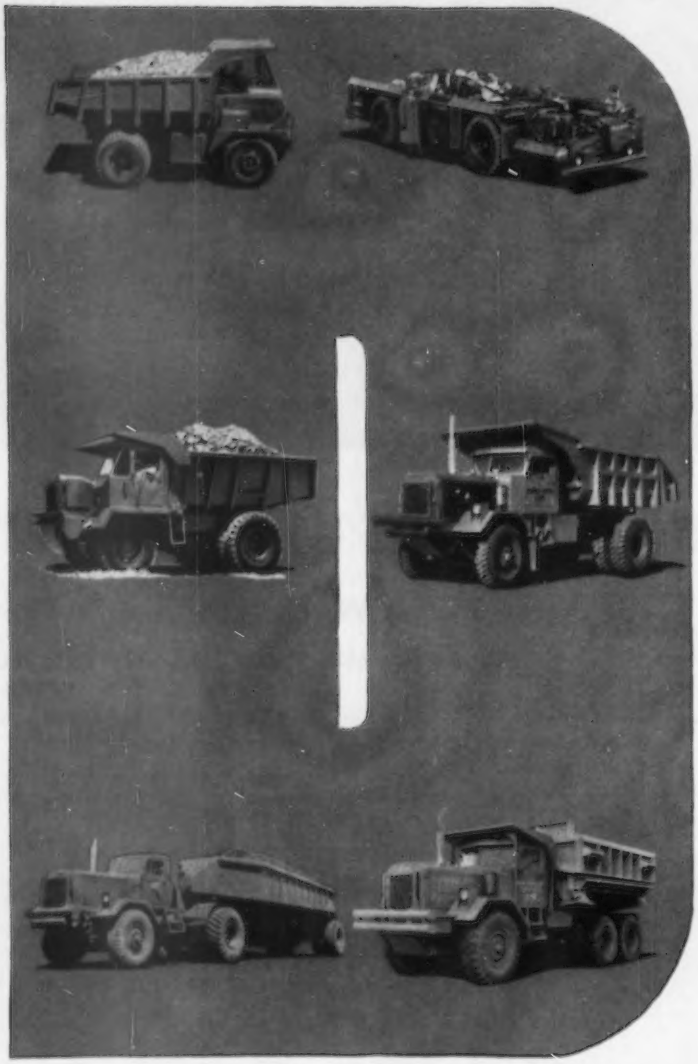
10 Ton to 55 Ton Capacity

MODEL 10-S — 10 ton end dump truck, powered by 150 H.P. Diesel Engine. 13,000# front axle with 17¼" x 3" air brakes. 26,000# full floating double reduction rear axle with 16½" x 7" air brakes. 12.00 x 20, 16 ply rock lug tires all around. Hydraulic steering. Approximate weight with body and hoist, 20,000#.



MODEL 18-S-UG-S—18 ton underground truck powered by 200-300 H.P. Diesel Engine with torque converter and fully reversible transmission. Hydraulic motor operates steel apron conveyor. Equipped with exhaust scrubber. Hydraulic steering. Operates as shuttle car. Height, 60"; width, 11'-0"; length, 28'. Approximate weight, 43,300#.

MODEL 20-S — 20 ton end dump truck powered by 225-275 H.P. Diesel Engine 20,000# front axle with 17¼ x 4" air brakes and 70,000# full floating planetary rear axle with 20 x 9" air brakes. 14.00 x 24, 20 ply rock lug tires front, 16.00 x 25, 24 ply rear. Hydraulic steering. 5 speed transmission or torque converter with 4 speed transmission. Approximate weight with body and hoist, 35,000#.

MODEL 25-SL — 25 ton end dump truck, powered by 300 H.P. Diesel Engine. D-75-S rear axle, 100,000# capacity. FU900 front axle, 25,000# capacity. 20 x 9" air brakes. Torque converters optional. Hydraulic steering. 14.00 x 24 front tires, 18.00 x 25, rear tires. Approximate weight, 48,000# with body and hoist.

MODEL 50-S-BDT — 60 cubic yard bottom dump coal hauler. 300 H.P. Diesel Engine, Allison converter and 3 speed transmission, or optional Twin Disc converter and 4 speed transmission. Trailer axle, 85,000# capacity, 20 x 9" air brakes, hydraulic dump. Approximate weight, 68,000#.

MODEL 35-T — 35 ton side or end dump truck, powered by 300-400 H.P. Diesel Engine, 25,000# front axle with 16.00 x 25 tires all around. 200,000 tandem full floating rear axle. Torque converters optional. Hydraulic steering. Approximate weight, 70,000# with body and hoist.

D-115

DART TONNAGE ENGINEERED TRUCKS

Kansas City 8, Missouri

SUBSIDIARY OF THE CARLISLE CORPORATION

Dependability

LORAIN-72
REPORT
from Valley Dolomite Corporation

LORAIN-72 FEATURES

- **TURNTABLE FEATURES** . . . 3-shaft turntable design — permits simultaneous hoist, swing and travel • High-efficiency, double center drive power transmission • Torque Converter power take-off available • Hoist Drums on anti-friction bearings • Metered Air controls for hoist, crowd, retract, travel, boom lowering and derricking available.
- **BOOM FEATURES** . . . 30-ton crane, clamshell, dragline, hoe • Independent chain crowd shovel • Full manganese shovel dippers • Air power controlled dipper trip • Air crowd brake also available.
- **CRAWLER FEATURES** . . . 2-speed chain driven crawler (¾ and 1½ MPH) • All crawler propelling mechanism and steering mechanism run in oil bath in oil-tight housing • Full air power crawler steering • 4-way tread-travel lock • Full air power control of tread-travel locking pawls . . . also available for travel-crowd jaw clutches.

TELEPHONE MAIN 1-2000

VALLEY DOLOMITE CORPORATION

[illegible]

ST. LOUIS 1, MO.

The Thew Shovel Company
Lorain, Ohio

February 3, 1956

Gentlemen:

This will give you performance information in regard to our Lorain-72 shovel.

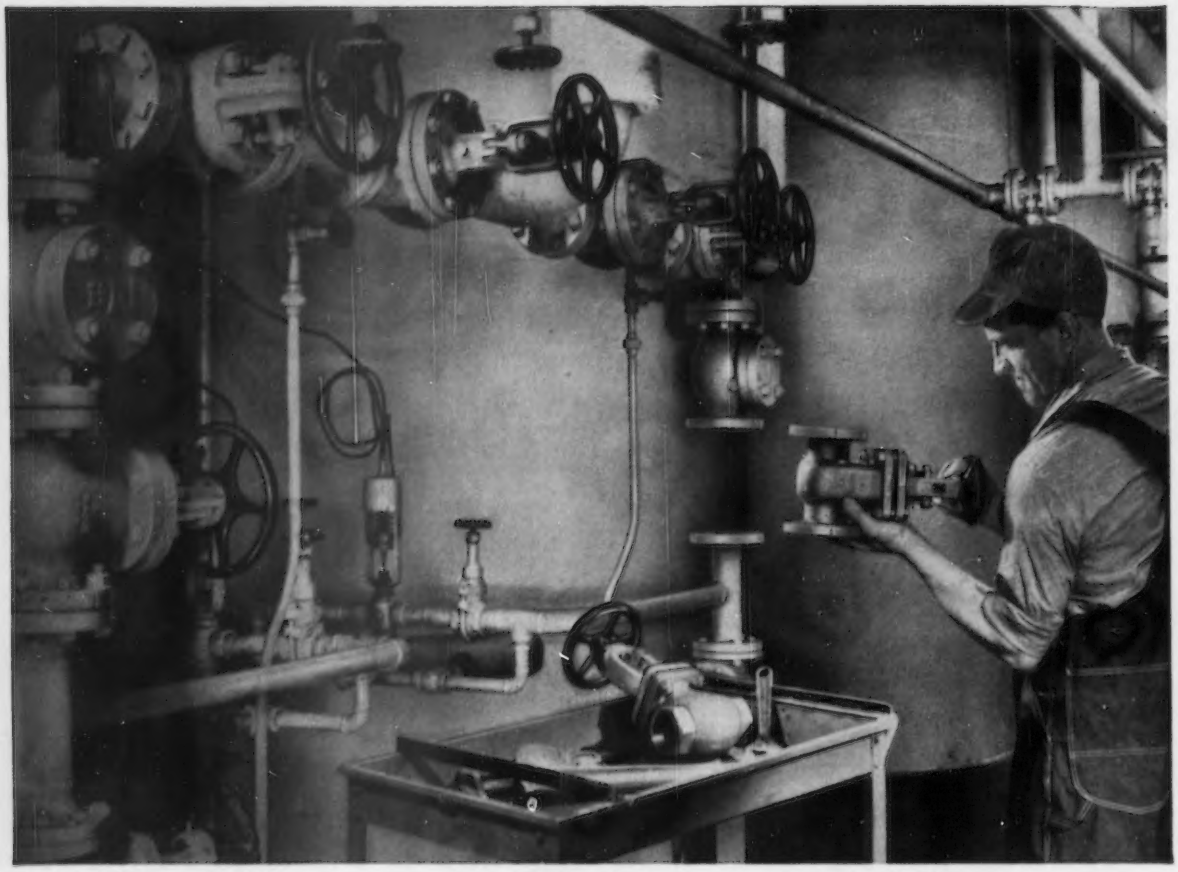
It works one shift of approximately 7-1/2 hours per day, 5 days per week throughout the year. It is equipped with a 1-1/2-yd. dipper and is our first shovel to be equipped with a Torque Converter and Metered Air.

This is the fourth Lorain shovel which we have purchased and all of them are still in excellent operating condition. We started out with an L-75D with 1-1/4-yard dipper in early 1937. In 1941 we added an L-79 with 1-1/2-yard dipper. In 1950 a model Lorain-820J with a 2-yard dipper was purchased and finally last September the new L-72.

We are at present operating all four of these machines on both open pit quarry rock work as well as stripping.

Yours very truly,

[signature]
Vice President



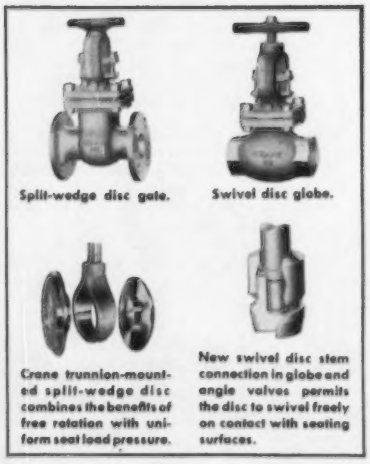
Corrosion meets match in Crane 18-8 SMo and Craneloy 20 valves

It's unanimous! These Crane valves for the process industries were *especially designed* of Crane alloys to cope with costly corrosion and to cut replacement costs.

The gate valves feature a simple, split-wedge disc construction which permits discs to rotate freely within guides and to seat tightly at all points on the seat perimeter. The free movement of the disc, plus uniform seating and unseating pressures, minimizes galling and seizing, reduces wear and allows smooth operation under all conditions.

Globe and angle valves now feature a modified plug-type disc that combines the advantages of the easier seating of the narrow ball-to-flat seat and the high resistance of the wider plug-type disc to corrosion, erosion and cutting. In addition, these valves offer a new swivel disc-stem connection that seats the disc squarely every time. Minimum clearance eliminates vibration.

These valves are available in 18-8 SMo and Craneloy 20 . . . in gate, globe, angle and check patterns . . . ½" to 6" . . . screwed or flanged ends. Rated 150 p.s.i. at 500° F.—230 p.s.i. at 100° F. *For more detailed information*, confer with your CRANE representative or write to the address below for the 12-page circular AD-2080.



Split-wedge disc gate.

Swivel disc globe.

Crane trunnion-mounted split-wedge disc combines the benefits of free rotation with uniform seat load pressure.

New swivel disc stem connection in globe and angle valves permits the disc to swivel freely on contact with seating surfaces.

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with the

Tractomotive TL-12 TRACTO-LOADER

Long experience in building the famous Tracto-Shovels serves Tractomotive well in manufacturing its line of wheel loaders. They know the timesaving advantages of the hydraulic torque converter drive from working with it in crawler tractors . . . and know how to apply it to a wheel loader. That's why you get smooth, fast loading with the TL-12 Tracto-Loader — no slow, mushy starts and stops — torque is multiplied THREE TIMES!

Tractomotive also developed the CLUTCH-TYPE TRANSMISSION in wheel loaders — saves gear shifting . . . operator just pulls a lever to change direction.

In addition to these timesaving advantages, you get a TIP-BACK BUCKET which gives you a "scooping action" to further speed loading. This feature also enables you to carry a full bucket at a lower position — means greater stability, easier maneuvering, better visibility.

There is 4-WHEEL DRIVE for excellent traction and POWER STEERING for easy handling under all operating conditions . . . plus high lift and long reach, strong, pin-connected axles, unit assembly of major parts — many performance and service features that save time and money.

It's the combination of advantages that makes the TL-12 an outstanding excavator-loader . . . but the best way to size it up is to see it in action, on your job, under your operating conditions. You will be in for a new, timesaving experience.

The Latest in Loaders...
By the Leader in Loader Design

Brake hp: 63 gasoline, 77 diesel
Weight: 12,100 lb, gasoline, 12,300 lb, diesel
1 ⅛ cu-yd Tip-Back Bucket

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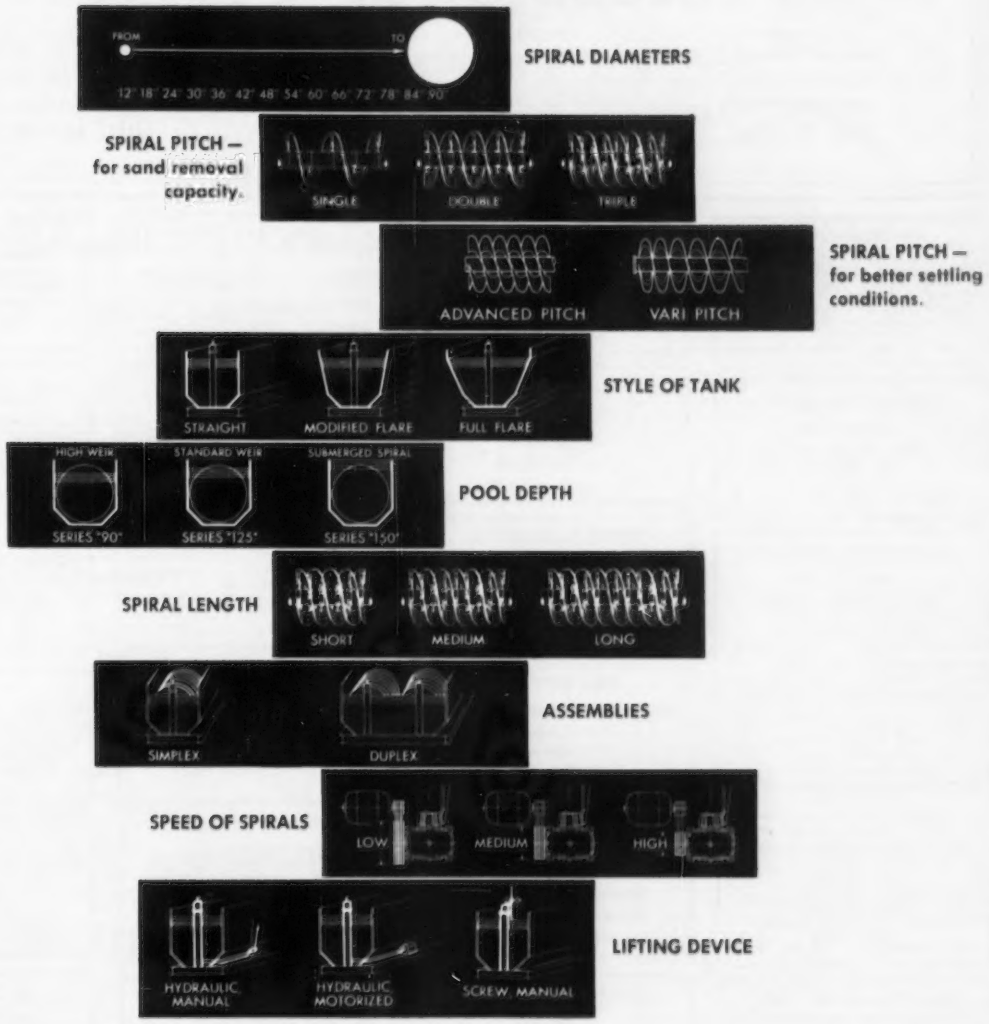
WEMCO S-H CLASSIFIERS



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Large operators world over choose Wemco S-H Classifiers — for a number of technical reasons like performance, structural strength and simplicity of design — but also for another reason just as important: **From WEMCO they can always get exactly the right machine for any specific need.** For your plant, too, no matter what its size or its circuits, you also will find exactly the right classifier in the many options that Wemco offers.

Write for bulletin C1-52

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Telephone BArclay 7-9484

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AMEDEE A. PEUGNET
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Telephone MAin 1-1431
705 Chestnut St., St. Louis 1, Mo.

ROGER V. PIERCE
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Telephone — Empire 3-3973

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The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

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Send NEW ADS to ENGINEERING & MINING JOURNAL, 330 W. 42nd St., N. Y. 36, N. Y. for May issue closing April 20th

PROJECT ENGINEER WANTED

Graduate Mining, Metallurgical, Chemical or Mechanical Engineer, preferably 25 to 35 years old, wanted by medium size progressive heavy machinery manufacturing company located in Southeastern Pennsylvania. To assist in design and preparing for market of various lines of equipment used in mineral dressing, heavy chemical, cement and rock products industries. Must have had engineering and field experience, and be willing to work on drafting board, travel and do field service. Opportunity also exists for a properly qualified individual, eventually to become a sales engineer. Salary open.

P-7533 Engineering & Mining Journal
330 W. 42nd St., New York 36, N. Y.

GEOLOGIST—MINING ENGINEER

Services of graduate geologist or mining engineer with exploration drilling and mine management experience sought by large company for mining project management position. Please forward qualifications and salary desired to—

P1088 Engineering & Mining Journal
330 W. 42 St., New York 36, N. Y.

WANTED EXPERIENCED MAN

TO ASSEMBLE AND TEACH OPERATION OF A FIVE YARD PAGE WALKING DRAGLINE MODEL 618 IN SOUTH AMERICA.

Contact: ST. JOHNS TERMINAL CO.
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Naturally, you are anxious to secure the most suitable man or men available. You want men with the special training that will make them an asset to your organization. You can contact such men through an advertisement in this EMPLOYMENT OPPORTUNITIES section. For information write:

Classified Advertising Division

ENGINEERING AND MINING JOURNAL

330 West 42nd Street
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Age 30 to 45 with B.S. or Engineer of Mines degree in mining or ore dressing metallurgy with 6 to 10 years' experience as superintendent or assistant superintendent of a medium sized operation, to operate an open cut mining and gravity ore dressing operation in Arizona. Will also be responsible for payrolls personnel, labor and internal office work on the operation. Salary $8,000 to $10,000 per year.

P1123 Engineering & Mining Journal
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Nation wide recruitment through 54 offices of the National Ass'n of Personnel Consultants at no charge to the employer. The Pacific Northwest's leading employment firm.

ACME PERSONNEL SERVICE
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REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

U. S. Company operating in Central America has opening for Engineer capable routine mine surveying and assist Chief Engineer in checking native transitmen and samplers. Two year contract. B.S. beginner or experience equivalent. Knowledge Spanish helpful but not essential. Married man preferred. Well established camp with adequate facilities for dependents. P-9145, Engineering & Mining Journal.

Research Metallurgist required for Island of Cyprus. Metallurgical engineer or mining engineer with good training and experience in metallurgy to conduct tests for improving practice in 100 ton per hour mill floating heavy copper sulphide ores and also to conduct tests on grades and mixtures of varying copper content. Aptitude and interest primarily research. Age 30-45 years. Three year contract. Salary open. Submit complete record and list of references with first reply. Cyprus Mines Corporation, 523 West Sixth Street, Los Angeles 14, California.

Assistant Superintendent for 1000 t.p.d. silver-lead-zinc mine and flotation mill Northern Mexico. Experience in Mexico or Latin America is essential. Technical education necessary. Give references experience record and salary desired with first letter. P-9287, Engineering & Mining Journal.

Junior Metallurgist, to perform control work and ore dressing research in a 5,000 ton magnetic-gravity-flotation mill. Excellent opportunity for recent graduate. Liberal housing policy and benefits. Location Northeast. Salary open. P-9008, Engineering & Mining Journal.

Ore dressing engineer and technicians to handle test work in commercial laboratory. Engineer to assist in plant design, cost estimation, and engineering controls. Age 25 to 35. Preferably B.S. mining degree. Excellent opportunity to grow with progressive organization. Salary commensurate with experience. Headquarters Florida. P-8873, Engineering & Mining Journal.

POSITIONS VACANT

Wanted — Engineer, preferably mining or civil, for technical service. Work involves development, manufacture, sales, and use of commercial explosives. Location Southwest. Recent graduate or man with limited experience preferred. Submit resume to General Superintendent, Apache Powder Company, Benson, Arizona.

Graduate Mining Engineer, 35 to 40 years old. Experienced in open pit mining. Will assist in planning of pit operations and be responsible for coordination of engineering and development with operations. Location: Northwest. When answering, give complete details, qualifications, references and salary required. P-1091, Engineering & Mining Journal.

Staff Engineers under 50 years of age wanted for challenging project work in mines, mills, smelters, and refineries for major copper and nonferrous producer. Want self-reliant and able engineers with mining or metallurgical backgrounds for engineering, design, procurement, and construction work, as well as younger inexperienced men. Must be willing to travel worldwide as required from central engineering department in Salt Lake City, Utah. Salary open. Reply with full details to P-1183, Engineering & Mining Journal.

Field Diamond Driller: Expanding new diamond drill contracting company in Peru requires a field diamond driller, with a minimum of eight years experience in all types of drilling. Preferably single man. Good salary and participating of the profits. Partnership considered. Passages paid. Write to Comania Diamantina B-H., Apartado 106, Lima-Peru, or Edificio Boza 312, Lima-Peru.

POSITIONS WANTED

Mining Engineer, eight years as manager and consultant producing mines. Broad experience in operation and development, design and construction of mining and treatment plants, labor negotiation. Married, children. PW-9510, Engineering & Mining Journal.

French Engineer, 35, English wife, daughter 6 years. Good experience in production of tin, lead, silicium, ferro-manganese, grey iron, sodium silicate in electric furnace, grey iron and bronze foundry. Employed Central Africa. Contract ends August 1956. PW-9563, Engineering & Mining Journal.

Mining Geologist—Varied geological & engineer-ing experience. Free to travel. Age 31. Employed. Wants responsible position with aggressive expanding company. Reply PW-1249, Engineering & Mining Journal.

Mining Metallurgical Engineer with wide experi-ence in process and equipment specification flowsheet design equipment selection and purchasing, plant layout construction and operation. Also mine examination and management. PW-1199, Engineering & Mining Journal.

PART TIME WORK WANTED

Geologist, Ph.D., 7 yrs. exploration experience, now engaged in university work in winters. Desires part time work for field seasons and winter research. Prefers association with exploration company in Rock Mountain area. Apply PTWW-1068, Engineering & Mining Journal.

AVAILABLE JULY 1st 1956

MINING ENGINEER — Graduate E.M. degree. Age 31. Single. Seven years experience as Mine Engineer, Shift Boss, Mine Foreman and Safety Engineer. Fluent written and spoken Spanish. Desire Latin-American position.

PW 1233 Engineering & Mining Journal
330 W. 42nd St., New York 36, N. Y.

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FLOTATION EQUIPMENT complete including pulp sampler and distributor, mineral jigs 6 cell flotation machines, super charger, agitator, 4" concentrate pumps, reagent distributors, etc. Used only 300 hours.

WEMCO MOBIL SINK FLOAT PLANT with 10 ft. cone, etc.

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ROD MILLS: 2—Marcy Open End size 5' x 14'.

PAN CONVEYOR: 48" x 110 ft., 100 H.P. motor, 440 volt, with speed reducer and drive.

PAN FEEDERS: Heavy duty manganese 60" x 14 ft., 20 H.P. motor, 220/440 volt, with speed reducer

JAW CRUSHERS 9 x 12, 10 x 20, 15 x 36, 18 x 30, and drive. NEW condition. Link Belt 36" x 10 ft. with motor and reducer.
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LOCOMOTIVE CRANE: 25 ton capacity, standard gauge, gasoline powered, cast steel trucks, air tion. Located Minnesota. For sale or rent. brakes, with or without 1½ yd. Williams clam shell bucket, thoroughly modern, excellent condi-

SLUSHER HOIST: Ingersoll Rand 50-MNM4C, 3 drum, 50 H.P., 220/440 volt. Also, one 15 H.P., 2 drum.

MINE HOIST SPECIAL: Vulcan 650 H.P., double drums, 8' dia., 7'6" face, one drum clutched, 1⅝" rope, 1400 FPM, thoroughly modern, with control and safety devices.

MINE HOISTS: Single and double drum 100 to 2500 H.P., with all electrical equipment. Complete specifications, drawings, photos available.

MOIST MOTORS:
300 H.P., 435 RPM. 600 H.P., 710 RPM.
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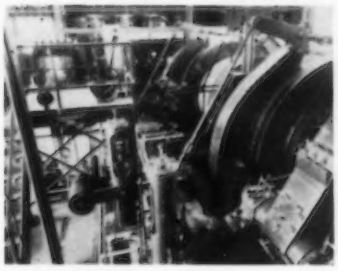
SERIAL NUMBER AND DATE: Unit Serial No. 740 — Built in 1928-29

PREVIOUS USER: Riverside Cement Company, Riverside, California



COMPLETE AS FOLLOWS:

DRUM DIMENSIONS: 2 parallel drums, cylindrical, 7' diameter, 5' face, 7" flange depth, 7'0" center to center of drums, 8'2" diameter drum flanges.

CONSTRUCTION OF DRUMS: ROLLED PLATE STEEL SHELL—1½" thickness, grooved for 1¼" diameter Rope.

DRUM CAPACITY: 931 ft. 1¼" rope each wrap; number of wraps varies according to state laws.

DRUM SHAFT: 12⅛" diameter through drums, three bearings.

BRAKES: Hydraulically operated, post type. Brake ring each drum is 10'0" diameter, 13" face. Brake blocks 3" thickness, with rubbing area each brake beam 1130 sq. inches.

CLUTCHES: Each drum separately clutched, hydraulically operated. Axial friction type clutches on ends of drums, clutch ring diameter 6'7", total area friction blocks 3166 sq. inches.

HYDRAULIC SYSTEM: 2 Northern Pump Company accumulator oil pumps and piping. Brake and clutch cylinders 5" bore, 14" stroke.

GEARING: Single reduction drive. Enclosed herringbone gear—214 teeth, 1½ D.P., 14" face, cast steel; pinion—16 teeth, 1½ D.P., 14" face, nickel steel.

PINION SHAFT AND COUPLING: Pinion shaft is 6½" diameter with 2 bearings 16" long. Flexible coupling No. 19-C, Falk.

MOTOR: Westinghouse 300 HP wound rotor motor, 2200 volt, 3 phase, 60 cycle, 450 rpm, frame 1118-A, type CW, continuous duty 40° rise.
(This hoist was originally constructed to handle up to 450 HP motor, 600 rpm, so long as the rope pull on each drum does not exceed 22,100 lbs. This motor would increase rope speed to 950 fpm.)

ROPE SPEED AND PULL: 700 fpm rope speed with 12,000 lbs. unbalanced load pull—22,100 lbs. balanced operation.

LOCATION: Can be inspected in operation at Riverside Cement Company, Riverside, California, by appointment. (We own this hoist outright.)

PRINTS AND PHOTOS: We have a complete set of general prints, drum details, foundation drawing, actual photographs. Write for these if required.

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Equipment may be inspected from April 9th until time of sale.

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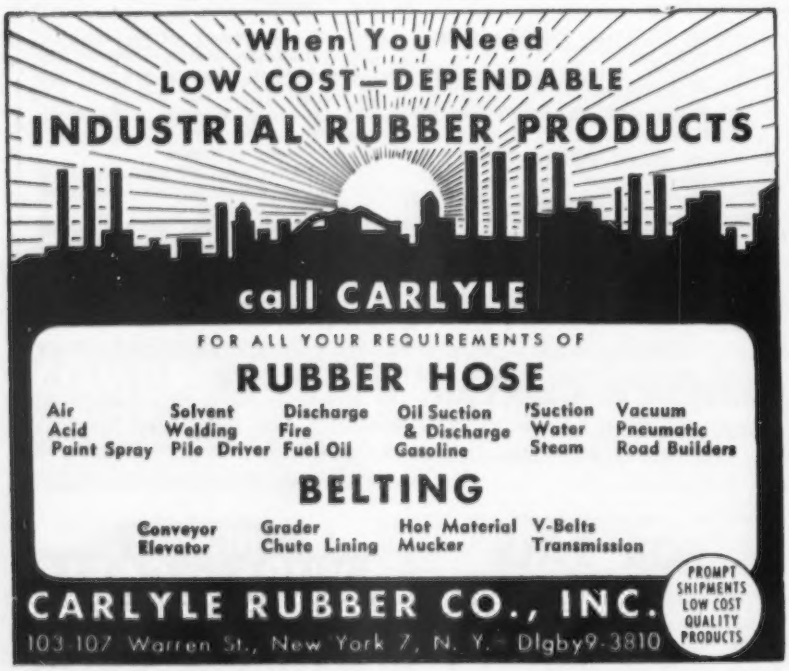

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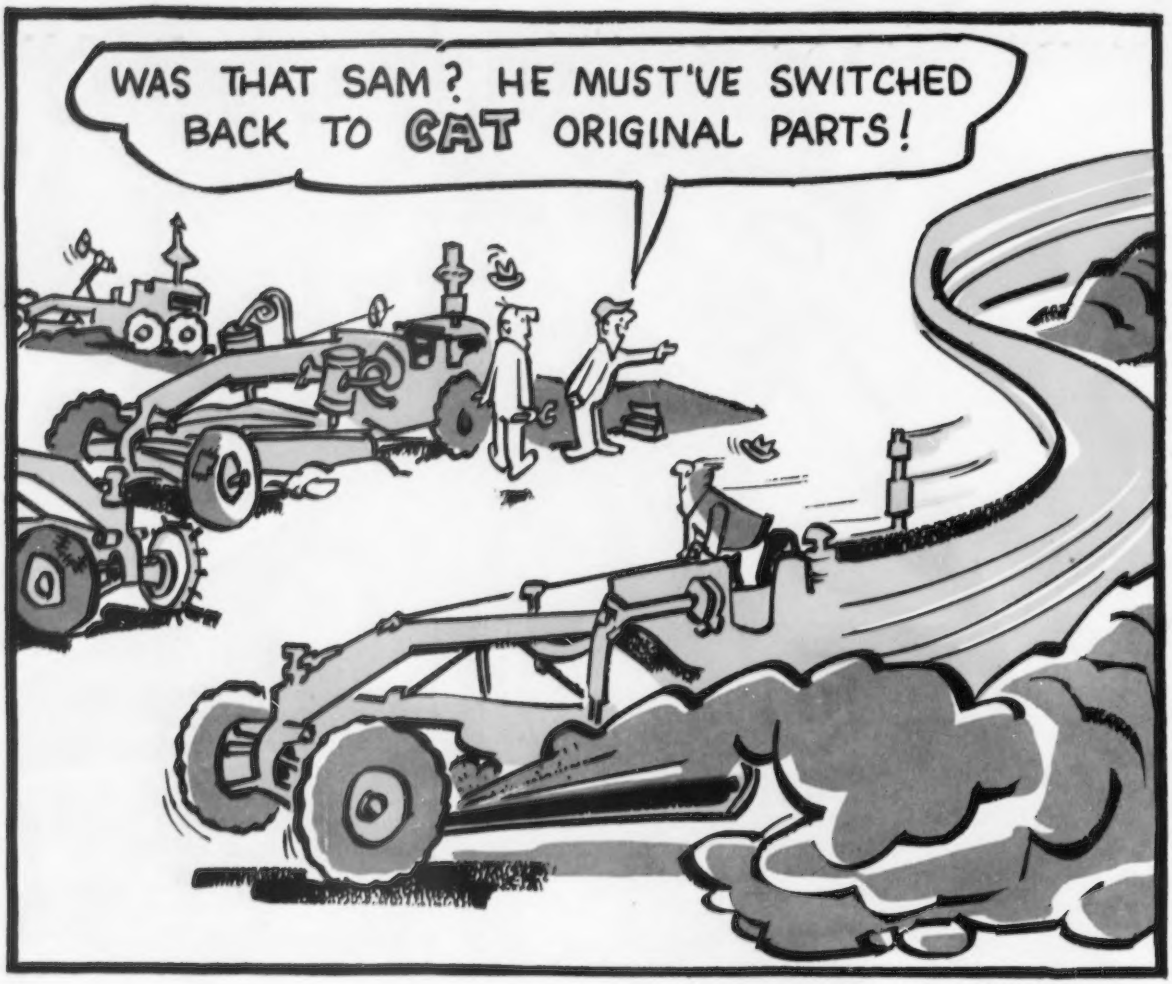


Take it from Sam. Beware of "just as good" substitutes.

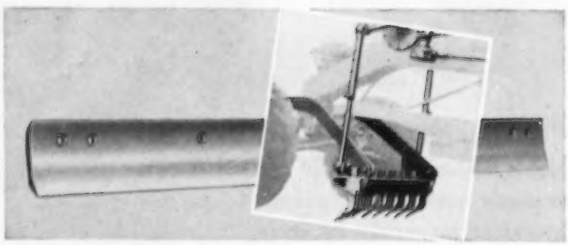
A cutting edge for your CAT* Motor Grader, for example. Caterpillar original cutting edges are made from only top-quality high-carbon steel—carefully pretested. Or scarifiers. If they're Caterpillar, the shanks are strong steel forgings mounted in a heavy cast steel block. Their replaceable teeth of forged alloy steel are selectively heat treated to resist wear.

You're sure of more dependable performance on any kind of job when you use only Cat cutting edges and scarifier teeth.

With substitute parts, can you be sure of anything?

See your dealer's Parts Representative—better get Caterpillar original parts every time.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.



Cat original motor grader cutting edges and scarifier teeth are the results of never-ending metallurgical research. They match the all-around performance of the quality machines they work with.

CATERPILLAR*

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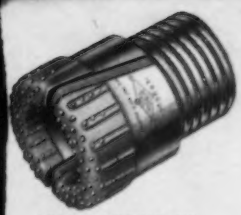


TRUCO CORING BIT

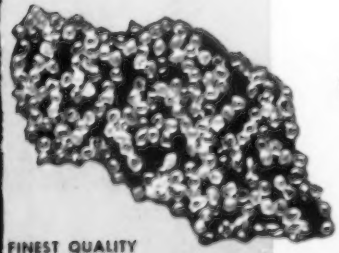
TRUCO CONCAVE BLAST HOLE BIT

TRUCO PILOT BIT

TRUCO IMPREGNATED CORING BIT

TRUCO REAMING SHELLS

TRUCO STANDARD OIL FIELD BIT



FINEST QUALITY DRILL BORTZ

in the American tradition

Twice a day a quick transformation overtook the old frame garage on John R Street, Detroit. At seven in the morning, the doors swung open, a spindly car chugged out and the garage became a busy little workshop. Some time after dark, the car was driven back in and, for a few hours, the workshop was a garage again.

As a workshop, it had for us a very special significance—it was here that our Company came into being and set up the first local shop devoted exclusively to making industrial diamond tools.

But, far more important, it was the first place in the whole midwest where industry could find a complete stock of fine industrial diamonds, imported direct to Detroit, and superior to stocks previously available only in New York.

Such convenience is taken for granted nowadays and the mails deliver thousands of our diamond selections yearly, but, in those days, it was an innovation and so useful that in almost no time at all, the old frame garage (which had cost $50.00) needed a 12-foot addition (which cost another $50.00).

And, that was but the beginning. Today, our plants are the most modern in the industry and in the intervening 46 years our laboratories have pioneered many of the most significant innovations in diamond tool technology, including *Engineered Diamond Tools** and Truco Engineered Diamond Bits.

And, today, in every major drilling operation throughout the world, Truco Engineered Diamond Bits enjoy a unique reputation for fast, accurate, dependable cutting in any formation and for their ability to deliver important economies in rig time and footage costs. May we send you the Truco Diamond Bit Catalog?

**Engineered Diamond Tools* are diamond tools *engineered* to the job and *guaranteed* to do it.

TRUCO DIAMOND BITS

by

WHEEL TRUEING TOOL COMPANY

3200 W. Davison Avenue, Detroit 38, Michigan

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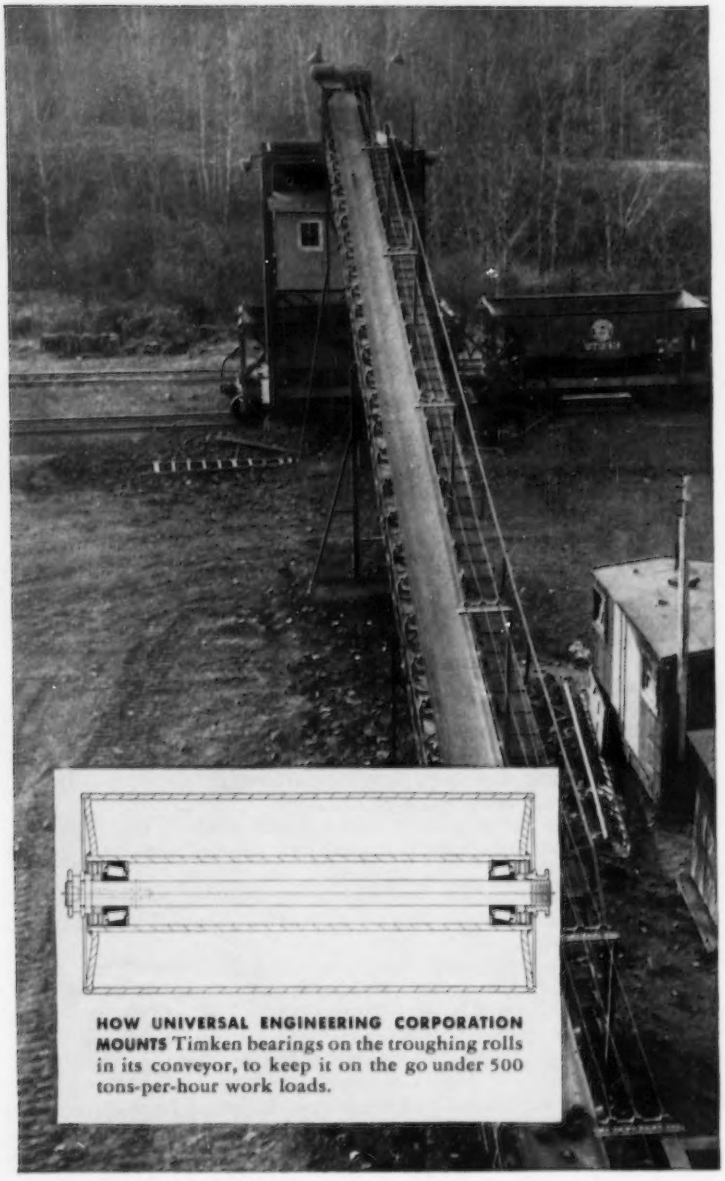
575 Langlois Avenue, Windsor, Ont., Canada

FINEST QUALITY
DRILL BORTZ

How Universal gets extra conveyor capacity without paying for it



HOW UNIVERSAL ENGINEERING CORPORATION MOUNTS Timken bearings on the troughing rolls in its conveyor, to keep it on the go under 500 tons-per-hour work loads.

UNIVERSAL Engineering Corporation gets extra load-carrying capacity in its conveyor systems by mounting the troughing rolls on Timken® tapered roller bearings. And by using Timken bearing sizes that are mass produced for the automotive industry, they get this extra capacity at a lower cost than they'd pay for the smaller bearings normally used.

Timken bearings provide high load capacity because their tapered construction provides full line contact between rollers and races. The Timken bearing is the only tapered roller bearing proved by 25 years or more of service in heavy-duty conveyors using the popular dead shaft construction.

Timken bearings are designed by geometrical law to have true rolling motion and precision manufactured to live up to their design. Made with an extremely smooth surface finish, Timken bearings practically eliminate friction. Result: You get longer roller and belt life because there's less sliding and scuffing. There's less maintenance, too.

What's more, Timken bearings aren't just lubricated for "life", but lubricated yearly, or as conditions require, to insure *long* life. Fresh lubricant ends any chance of gummy, sticky, jammed bearings.

The long life of Timken bearings and dependable performance cut maintenance to a minimum—your costs to the bone.

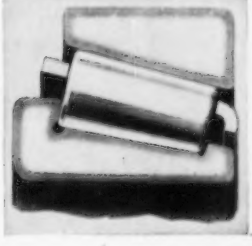
Whether you're building or buying any kind of machinery, specify Timken tapered roller bearings. They're designed right, made right, made of the very best steel. In fact, we even make our own steel; America's only bearing manufacturer that does. So make sure the bearings in your machinery are stamped with the trade-mark "Timken". The Timken Roller Bearing Company, Canton 6, O. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



HARD ON THE OUTSIDE, TOUGH ON THE INSIDE

Rollers and races of Timken bearings are case-carburized to give a hard, wear-resisting surface over a tough, shock-resisting core. Result: longer bearing life.

Only Timken tapered roller bearings have these advantages: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. Timken fine alloy steels.

NOT JUST A BALL ○ NOT JUST A ROLLER ⊂⊃ THE TIMKEN TAPERED ROLLER ⊂⊃ BEARING TAKES RADIAL ◊ AND THRUST ←◊→ LOADS OR ANY COMBINATION